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The AUTOMOBILE

Boillot changes mounts at the conclusion of the French Grand Prix. Enthusiastic admirers of the victorious Peugeot driver shoulder him off the course on his arrival at the finishing line

The Humanities of a World's Record

Lap-by-Lap Word Pictures of the Superhuman Struggle for Victory in France's Greatest Road Race — Accidents and Their Causes

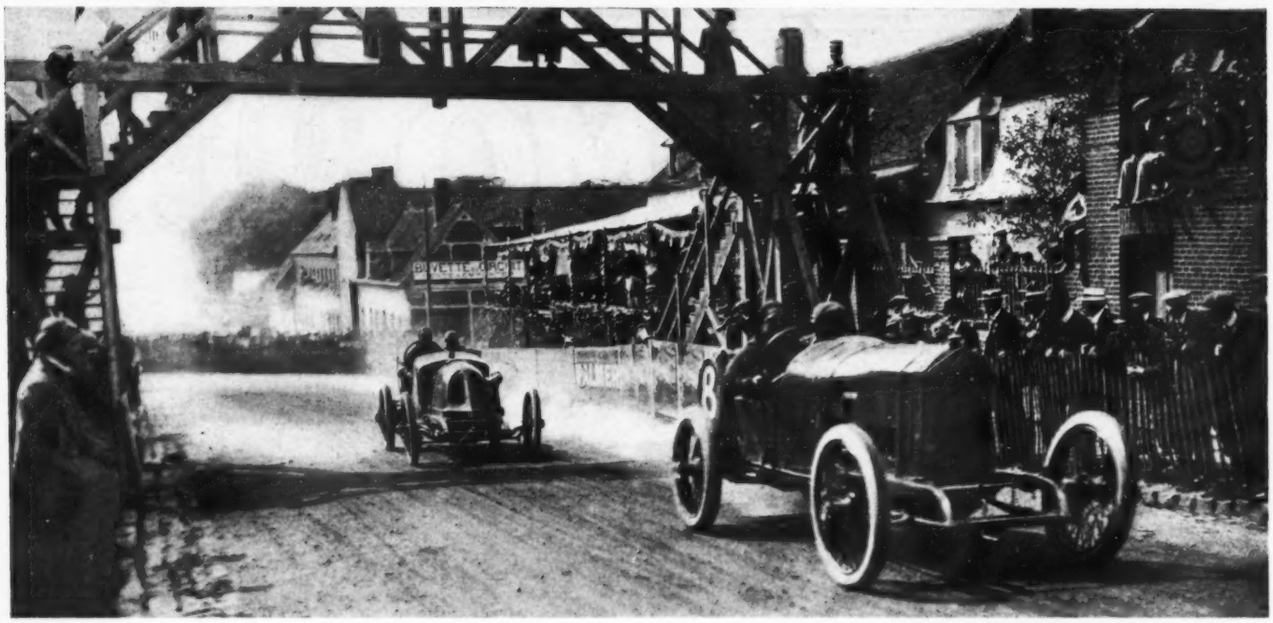
W. F. Bradley, Staff Representative of THE AUTOMOBILE, Gives His Course-Side Impressions of the Great Speed Duel at Amiens

AMIENS, FRANCE, GRAND PRIX RACE COURSE, July 12.—Thick fog prevailed at the hour fixed for the start of the French grand prix at Amiens today. To send cars away under such conditions would have been disastrous. A halt was therefore called until 5.30, when it was possible to see a distance of a couple of hundred yards, certainly not more. The morning mist was an indication that the day would be hot as it grew older and carbureter conditions probably satisfactory. The starts were not brilliant. Every man had 183.3 liters (40.3 gallons) of gasoline in his sealed tank, and it was impossible, under any conditions, to obtain a drop more. Economy was therefore the order of the day and it was carried out to such extremes that drivers would not warm up their motors in advance and went off with such thin mixtures that there was considerable misfiring and in some cases motors were stalled. The only cars to make a really good start were the three rotary valve Italas.

Of the really important drivers the least brilliant was Bablot on Delage. He was so careful not to use a spoonful more than necessary that he stalled his moter twice. He lost 3 minutes at the starting line. After 2 miles on the level and slightly downhill, he reached the first stiff rise. Carbureter conditions were still so unsatisfactory that his motor stalled. Not being a particularly strong man, and tired out with his exertions at the starting line, the mechanic was unable to crank. Bablot was unable to give any help, for he is partially paralyzed in one arm and incapable of turning over a big, high compression motor. The mechanic had to rest; still he was unable to crank the engine. Finally Bablot put in his reverse gear and let the car run backwards. He had lost another 5 minutes and with it all chance of winning the race. This first lap had been so badly managed that he came in sixteenth, with only four machines behind him.

From this first lap Bablot warmed up; he jumped three places on the second lap, three more on the third, then two, then one, then one more. He established a record, he broke it again and again; he showed a speed of 77 miles an hour for one lap, but for all that he was unable to get ahead of the Peugeots or to catch the fastest of the Sunbeams.

It was not the end of the Delage ill-luck. Guyot, on a similar machine, finished his first lap in fourth place; he kept it for the second lap, got into third place, then into second, and was leading on the ninth with a small but safe margin over Goux and Boillot. For eight successive laps—nearly 160 miles—Guyot led the field, Goux and Boillot thundering after him, but were unable to get within 2 minutes of the powerful and regular Delage. Guyot started on his seventeenth lap—twenty-nine had to be covered in all—and failed to appear at his regular time. Minutes passed, there was gloom in the Delage camp. Boillot took up the leading position, Goux went second, Chassagne on Sunbeam went into third place. Finally Guyot's Delage appeared, traveling at a moderate pace. As he pulled up, Guyot yelled "new mechanic." In a flash a blue overalled helper, hatless, and with the yellow pit attendants' badge on his arm, had vaulted up onto the track. He jacked up the car, began changing the two rear wheels while Guyot helped his original mechanic out of the car



Boillot passes Thomas on the Schneider on Moreuil hill. Circle—Goux, on the Peugeot, cresting hill at Moreuil

and quickly but gently passed him over to the pit attendants below. It was only when the car had gone in its desparate chase after the now leading Peugeots that the wounded man was asked to relate what had happened. Going at speed, a tire had burst. In his excitement the mechanic had jumped out of his seat while the car was running at a fairly high speed. He had estimated that the car was not going at more than 12 miles an hour when he vaulted, but in reality it must have been traveling at 20 miles an hour. The unfortunate mechanic was knocked down and the car went over him. Although no bones were broken, he suffered severe flesh wounds. Although a strong, powerfully built man 6 feet in height, he lost consciousness under the pain To abandon his mechanic with the doctors stationed round the course would have meant disqualification; to wait for him to return to consciousness meant losing the race. When he came round, Guyot lifted his helper back into the car. He suffered to such an extent that it was impossible to drive fast. This incident lost Guyot the race. He never touched a tool, never raised his bonnet, never added a drop of water, ran with clock-like regularity throughout, but with the hardest possible chasing he could not gain the lost 5 minutes on the Peugeots.

Some fine struggles were witnessed between the two Peugeots and the two Delages. On one occasion Goux came to the grandstand track 10 yards behind the Delage driven by Bablot. When they got round the second turn into the straightaway the Peugeot's front wheels were level with the Delage rear axle. For 150 yards they raced neck and neck at 70 miles an hour. Just as they reached the top of a long descent Goux dashed ahead and the two cars chased each other down this long hill at a speed of 108 miles an hour.

Victory Certain at Last Minute

Boillot's victory was not certain until the last few minutes. With only four laps to run his moter began to overheat. He pulled up at the pits and pulled off his bonnet, while the mechanic went for water. Clouds of steam escaped. Boillot knew that something was the matter, for his motor had been knocking badly previous to this stop. It was found that the rubber connection had burst, allowing a large quantity of water to escape. A hasty repair was made with rags and tape. Owing to this stop Goux got within 6 seconds of his rival. There was still more trouble, for one of the sight feeds cracked. Owing to the special lubricating system, any serious escape of oil at this point would

be fatal. It was possible, however, to make a repair while the car was in motion and the mechanic kept close watch on it. On the last round but two Boillot stopped again to be certain that the repair to the water connection was still good. It was leaking so little that a couple of pints of water were sufficient to make up the loss. The last two rounds were covered at high speed, Boillot increasing his lead on the field, although not succeeding in breaking the lap record set up by Bablot's Delage.

It was expected that there would be thrills on the grandstand track. This was a special concrete track, slightly banked, uniting the two main legs of the course, and having its corners rounded off. It was not banked sufficiently for the highest speeds, but 50 to 55 miles an hour could be managed with safety. Moriando, a dare-devil Italian, provided the only sensational incident with his rotary-valve Itala. He finished his first lap in seventh place and tackled the grandstand turn at a high clip. He had overcalculated his speed, for he shot wide and dashed into the cinder wall built up about 3 feet high all around the outer edge of the track. In a flash the car was over, lying on its left side, with

the men hidden in the cinder heap. Almost as quickly as they had gone down the men were up again and without wasting any time began to lift the car up on its wheels again. Fortunately they were powerful men or they would never have managed the task. When the car was right side up, the only damage was found to be a bent steering column, a damaged bonnet, and a burst tire. Within 4 minutes they were off again.

On the first round Delpierre's Peugeot overturned at the difficult S-turn under the railway bridge at Boves. This driver had taken the third Peugeot which should have been handled by Zuccarelli, and was driving it merely as an amateur. Evidently he was not sufficiently skilled for a task of this nature.

Joerns on the Opel only covered one round, when his lubricating system went wrong and he burned out a connecting-rod bearing.

Caillois, the Sunbeam race driver, was eliminated after four rounds by the breakage of his pressed steel torque member. These cars had a solid rear axle without differential.

The most sensational accident befell Lee Guinness on the Sunbeam. He had driven a very consistent race, holding sixth, then fifth position and had covered a little more than half the distance. Coming through Boves, where the road surface was rough and caused the cars to dance wildly, either a wheel broke or a tire burst. Guinness himself is unable to explain the exact cause of the accident. At this moment he was passing an opening to the river running parallel with the course through the village street. Half a dozen huge boulders placed there to prevent cars falling into the river, were swept away by the racing machine before it dived into the water 15 feet below. Guinness had not a scratch to show, and his mechanic was equally fortunate. A spectator standing behind the fencing was killed.

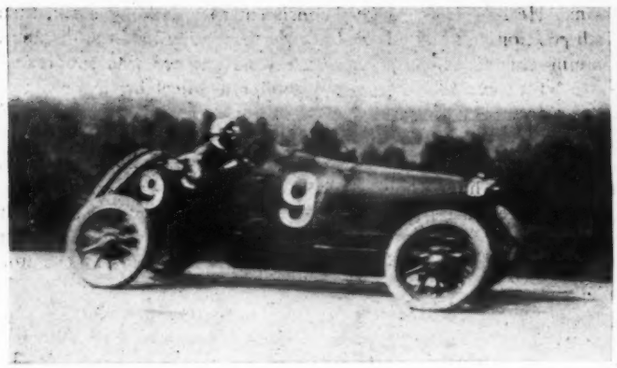
Resta of the Sunbeam team was held back by a detail. His reserve oil tank, built into the scuttle dash, sprang a leak, allowing all the lubricant to escape. It was therefore necessary to stop the car every two or three laps and pour oil into the crank-chamber.

There was very little tire trouble in the race. Boillot burst one Pirelli tire and changed another as a precaution. The Delage machines used four and five tires respectively. The two Excelsiors ran throughout on one set of Palmer tires. Chassagne, finishing third on Sunbeam, changed two Dunlops. Altogether the tire situation was satisfactory, for this was the longest road race in the world—570 miles,—and all European speed records were broken.

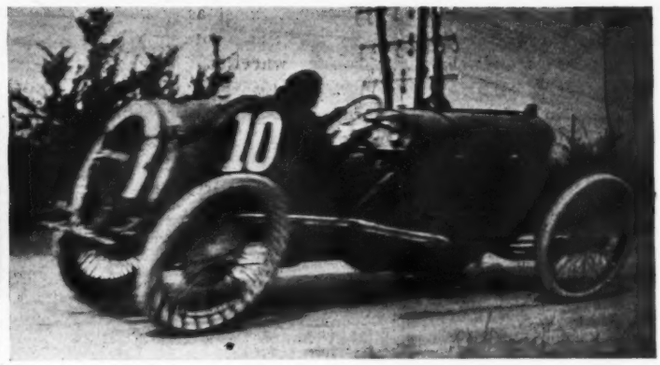
Care with Fuel Consumption

The fuel consumption situation was satisfactory. The leading cars had been regulated to consume 19 liters 200 per 100 kilometers, for a maximum speed of 108 miles an hour on the level. (The official allowance was 20 liters per 100 kilometers.) On the Peugeots, which developed 138 horsepower at 2,150 revolutions, the fuel consumption was 0.274 liters per horsepower hour. On the road the Peugeots consumed 13.5 to 19.200 liters per 100 kilometers, according to road conditions, and the motors were capable of running from 300 to 3,000 revolutions a minute. The weather conditions proving satisfactory, all the leading cars finished with a certain amount of gasoline in reserve, this varying from 20 to 23 liters for the Peugeots and the Delages. These two makes used Motricine at 740 density and 15 degrees centigrade temperature. The Peugeots had a waterjacket around their intake manifold, but the water was not put into circulation on the day of the race. The greater portion of the intake manifold was integral with the cylinder casting.

Circle—Bablot emerging from the railway arch at Boves. Chassagne steering his Sunbeam around the sharp bend at Moreuil



Speed Impression of Resta on Sunbeam



Guyot's Delage at 100 miles per hour

Champoiseau, on Schneider, making the turn at Moreuil

Unusual Attention Given To Details

MORE careful attention had been paid to the detail fittings of the 1913 cars than to any set entered in a road race. Guyot's Delage was lubricated with specially refined castor oil obtained from a specialist at Marseilles. Just before the cars were locked up in their box, on the night before the race, the old oil was drained off and 30 liters (6.6 gallons) of fresh oil were put aboard.

The Delage motors had two magnetos, one set across the front, and one on the left-hand side, the two being operated at the same time and firing a row of eight plugs down the head of the cylinders. There were separate switches on the dashboard, so that it was possible to tell which magneto was defective if any defect developed, and to cut it out. In the race this system gave complete satisfaction. It was declared that the speed of the motor could be increased 400 revolutions with the use of two magnetos. All water connections were stoutly wrapped with adhesive tape. The water pipes for heating the intake manifold were also taped and the same was done with the oil leads for the rocker arms. This part of the mechanism was oiled by hand, the pump being on the scuttle dash. To show the number of laps covered, a billiard counter marking 1 to 29 was fitted on the dash. Other fittings were a revolution counter, driven from a pulley on the front end of the crankshaft, a clock, a pressure indicator, a pivoted wire gauze windshield, and, in the centre of the dashboard, a skull and cross bones imported from Indianapolis. The steering wheel on Guyot's Delage was light steel construction with a pure rubber casing moulded on it. This casing is made in somewhat the same way as a tire shoe, fitted on the wheel, and closed up. It gives a remarkably good grip. According to the rules the gasoline lead was entirely external. Thick rubber pads were placed between it and the chassis frame and a tin casing was built around it, protecting the pipe from stones while leaving it visible according to the rules. The tank was mounted on a wood cradle and held down by felt lined bands. The spare wheels, one of each size, were mounted at the rear, but not in contact with the gasoline tank. The strap arrangement was such that by releasing one buckle the wheels were released and at the same time the key was available.

Not a single car started in the race with thermo-syphon cooling. Among those makers using thermo-syphon cooling for their stock cars but preferring the pump for racing were Delage and Schneider. This latter firm made use of the dashboard radiator, but built much lower than on the stock cars in order to reduce head resistance. The cylinders are in a single casting with valves on one side having inclined stems and a very large volume of water all round them. The water outlet is peculiar. In addition to a central outlet from the head of the cylinder, there were two other outlets on the left hand side and two on the right hand side of the group just a little below the top of the casting and towards the ends of the motor. The five pipes united in a central collector of big diameter going to the dashboard radiator. The level of the top of the valve caps was at least .5 inch below the top of the cylinder casting. From the pump there were two water inlets, one going to each end of the cylinder group. These end plates were detachable. All the Schneiders had forced feed lubrication to five plain bearings at a pressure of 200 pounds per square inch. To indicate the amount of oil in the base chamber a float was fitted, the stem having a cord attached to it and brought over two pulleys to the dashboard, where it received a balance weight. This weight was guided in a small diameter tube. As it was seen that the oil supply was diminishing, the mechanic supplied more by dumping a can in the mouth of a filler mounted on the left-hand side of the car. From the filler a pipe went to the base chamber, and as there was a tap at the base of the filler the supply could be shut off as the indicator showed the required level had been attained. The spare can could remain in position when the car was traveling at speed.

Itala presented three cars fitted with their special type of rotary valve. It was declared that the valve timing and size of openings were the same as on the stock cars, but no dimensions were given out. The cylinders were a pair casting, with the crankshaft carried on two ball and a central plain bearing. The lubricating system was under pressure with a pump in the base chamber.

With a view to getting the best results out of their motors, the Sunbeam drivers had fitted roller blinds in front of the radiator guard. The blind was kept down in order to quickly warm the motor, and also pulled down at any time during the race when the motor had a tendency to run too cold. The control of the blind was by means of two cords brought up to the mechanics seat All the Sunbeam cars had a coil tube condenser on the top of the radiator, and in two cases the pipe was brought aft to the level of the seats.

Cyclecars Better Racers Than Sidecars

AMIENS, FRANCE, July 12.—Twenty-nine competitors started in the Cyclecar Grand Prix, six of the machines being motorcycles with sidecar attached. These latter made a poor display, proving themselves decidedly inferior to the cyclecar for speed, reliability and steadiness on the road. The pace was set by Bourbeau on an air-cooled Bedelia. This machine had a twin-cylinder air-cooled motor with direct drive by means of long belts to the rear wheels. The motor was mounted on rails, with provision for moving it backwards and forwards, as desired, in order to take up slack in the belt. In addition the pulleys on the driving shaft were of the automatic extensible type and the rear axle was pivotable. Bourbeau was followed closely by Samuelson on a Marlborough entirely on car lines. The four-cylinder water-cooled motor developed overheating troubles, and after a plucky attempt to keep going the driver and his lady passenger had to drop out. After two rounds of the 11-mile course the leaders were Bourbeau on Bedelia, Samuelson on Marlborough, Esser on Mathis, Canouel on Sphinx-Globe, and Violet on Violet-Bogey.

On the first round Mundy on one of the Morgans pulled the spokes out of one of his front wheels while taking the grandstand turn. Forster, on the Sphinx-Globe, burst the crankcase of his J. A. P. water-cooled motor. Owing to lubrication troubles the motor had been taken down just before the race and had been assembled with sufficiently lateral play. One Morgan cyclecar went out early with a broken piston. One of the Automobilettes burst a tire when running at full speed, the driver was unable to hold the car and the racer finished in the ditch without any personal injury being received.

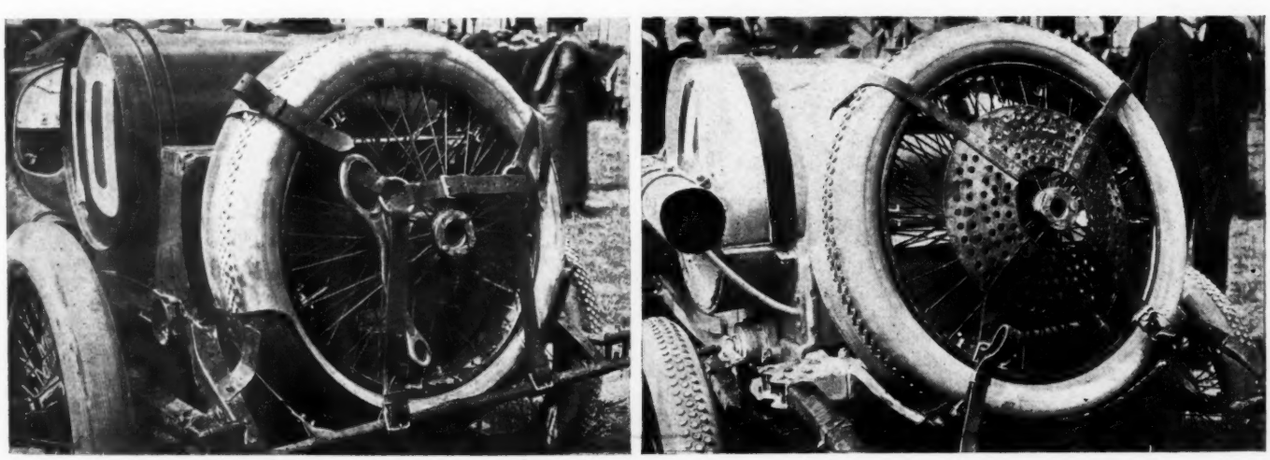
Although speeds were naturally lower, this cyclecar race was just as keenly contested as the big car race on the previous day. The fight was between McMinnies on Morgan, Bourbeau on Bedelia, Canouel on Sphinx-Globe, and Violet on Violet-Bogey. Violet provided the spectacular feature of the race, his turns in front of the grand stands being made at such speed that it was frequently a marvel he did not turn over.

During the race considerable trouble developed with mudguard attachments. One of those to be affected was Violet. When his mudguard came off he wished to leave it at the pits, but it was pointed out that this would entail disqualification. He therefore carried it round with him, but when about to enter the last lap he was hailed by one of the officials who wished to tell him that unless the mudguard was put in place the machine would be disqualified. Violet halted, wondering why he was being called, then thinking it was some mistake went away with a loss of 10 seconds. He might have come in first but for that stop. When he did get round to the pits it was to find that he had secured third place behind McMinnies and Bourbeau, but that a protest was lodged against him. It had been discovered that the rules called for the mudguards to remain in position throughout the race, although bonnets could be carried or not as desired. Under this rule the Mathis had to be eliminated after securing ninth place. Several other machines would have been affected by the same rule had they continued to the end of the race.

McMinnies won the race for Morgan at an average speed of 42 miles an hour, a rate of travel certainly most satisfactory for a little machine of only 1,000 cubic centimeters cylinder area. The winner carried a J. A. P. water-cooled motor set right in front with a radiator behind it. This machine had but three wheels, the drive being taken by shaft, two-speed gearset and chain to the rear center wheel. Bourbeau who came in second on the Bedelia had the only air-cooled motor in his team and, incidentally, the only motor to finish the race. The disqualified Violet was the only friction driven machine in the race.

So far as appearance was concerned, the Ronteix, which came in third, was on car lines. It had four-cylinder water-cooled motor in front, shaft drive to a countershaft with a sliding spar pinion on the end of this shaft meshing with different diameter crown wheels, and final drive by single chain. To average more than 40 miles an hour, it was necessary at times to touch 60 miles an hour. This was done without any wildness on the road. Out of twenty-three actual cyclecars which started in the race, ten covered the full distance, while of the sidecars which ran at the same time not one succeeded in covering the 163 miles.

Lee Guiness' Grand Prix Sunbeam after the plunge at Boves



How the spare tires were carried in the Grand Prix—Left, Guyot's Delage. Right, rear end of Mathis car

Metz Runabout Team Wins Glidden Trophy

Locomobile Captures A. A. A. Trophy in Touring Car Class—Anderson Cup Won by Hupmobile Runabout

GLACIER PARK, MONT., July 20.—*Special Telegram*—When the final results of the Ninth National Reliability Tour of the American Automobile Association, which ended in this city last evening were announced, the time-honored Glidden Trophy was won by the Metz team of three cars, all of which finished with perfect scores.

The individual entry for touring cars with the best scores and for which the American Automobile Association Trophy was the prize, was won by Dr. J. D. Park, Duluth, Minn., in a Locomobile.

The Anderson Cup awarded to the individual runabout entry with the best score was won on a draw by W. W. Munzer's Hupmobile of Minneapolis.

The *Minneapolis News* trophy was won by Metz entered by G. H. Viter of Boston, on a draw.

The Metz team which made a plucky fight from start to finish of the 1300-mile run, nearly lost its chance of victory by a broken steering knuckle which it was fortunate to get welded on the train welding plant, at the noon control at Shelby on the last day of the tour.

There were many thrilling experiences during the last day of the run. The winning Locomobile was compelled to make 21 miles in 69 minutes over bad roads and checked in but 1 minute ahead of schedule. This car is a 1910 chain-driven model.

One of the Hupmobiles was forced to go 14 miles on two rims and arrived 1 minute ahead of checking time, the driver collapsing after arrival owing to his fear of being late.

In the contest for the Glidden trophy, the Boston team of Metz cars were the only ones constituting a team to have perfect scores. Three of the other teams lost one or more points during the entire run to Glacier Park.

The Three winning Metz cars at Devil's Lake, N. D., control. C. H. Metz at the wheel of No. 6, C. Walter Metz in No. 7, and G. A. Voter in the center car

The Glidden Trophy won by the Metz

In the contest of runabouts for the Anderson Trophy, six runabouts finished perfectly, these being, Nos. 5, 6 and 7 Metz, No. 10 Krit and Nos. 14 and 15 Hupmobile. The award of the trophy was done by drawing, No. 15 Hupmobile securing the prize. Other finishers in this runabout class were No. 11 Kissel with 142 points penalty and No. 16 Little with 163 points.

The *Minneapolis News* Trophy for runabouts was tied for by the five machines in the Anderson Trophy class and in the drawing No. 5 Metz was the winner.

The tour officially ended at 7 o'clock this evening, after a long run from Havre. The forenoon run, the longest of the tour, was 112 miles to Shelby. The roads were sandy, choppy, and stony in turns, but wholly satisfactory for a good reliability test. The dry condition made it possible to take several of the bad hills safely. The afternoon run of the last day across ranges, two fords, and two dangerous hairpin curves, but with the last few miles over a part of the first automobile road in the National Park, built by Lewis W. Hill. By this road the automobiles were raised to the height of the divide and let down easily on the other side.

One hundred Pigan Indians in war outfit and on horseback escorted the tourists into the Park and then formed a circle while the cars were passing. There were 30 cars in line at the finish, some of these being non-contestants and others that had joined the tour as it neared completion. The procession to the finishing point was headed by President Enos of the American Automobile Association, with Referee Dr. C. E. Dutton of Minneapolis behind him and acting as pacemaker.

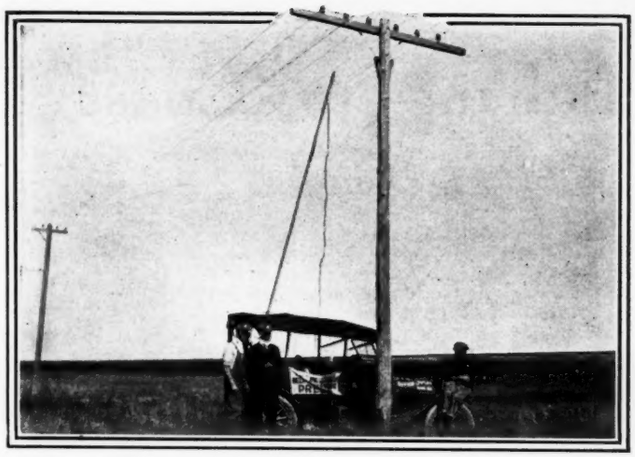
Pacemaker Mitchell six stranded 30 miles out of Glasgow, Mont., with broken steering knuckle

MALTA, MONT., July 19.—Close competition between the Boston Metz team and Minneapolis Krit team was shown last night at Glasgow when latter protested that former had worked 17 minutes overtime for each car at Poplar, Mont., the Thursday noon control, and it protested against eight points assessed against No. 8 Krit on the ground that the delay was due to tire trouble caused by the pacemaker striking rear end. At the time

the referee and chairman had transferred his flag to another car. The Metz team is working by whistle signals. C. H. Metz, president of the manufacturing company, rides or drives the first car and indicates by arm signals the speed as well as other directions. In rear seat, G. A. Voter uses a whistle to indicate directions, the cause of stop of any car, etc. The first car is called by whistle if either of the other two is stopped. All the team works on the car in trouble.

From Minot to Williston the run was over short hill country. The cars dipped from the top, shot down to a short stretch and up again. The road was good enough to take these dips at good speed and the tourists enjoyed it. E. W. McCreery, manager of the Goodrich company of Minneapolis, took the wheel of the Mulleavy Krit at Rugby, noon control, owing to injury to that driver's hand. The Kisselkar driver pulled a pinch of gumbo from his radiator, opening a tube. In the afternoon there was more sand than the tourists had found since leaving Minneapolis. Fifteen points against Kisselkar remitted, but 130 points were marked up at end of sixth day. Cadillac and Chalmers cars joined here.

From Williston, N. D., to Glasgow, Mont., the run was mainly across the Fort Peck reservation, 90 miles. The roads had been repaired in a dozen places, well enough for the day. At noon at Poplar 4,000 Sioux Indians from different reservations gave a dance and game entertainment for the A. A. A. people. It attracted hundreds of people from near towns who came by automobile. Bohn Fawkes withdrew No. 4 Marmon at Brockton because of a burned-out clutch. In the afternoon the pacemaker Mitchell cracked a steering knuckle 30 miles from control. The train was stopped, the welding apparatus dropped and the Mitchell arrived only a few hours late. Night running was slow, which contributed to delay. Louis W. Hill is a non-contestant, having entered a seven-passenger touring car and carrying full load. The order of the cars leaving controls is now in 16, 18 and 20-mile classes. Several non-contestant automobiles have fallen in line for Glacier Park at different controls. The route develops the fact that Montana is growing. Many trails used in the 1911 Minnesota state tour from Minneapolis to Helena are now fenced in; where there was a waste are now found claim hunters and irrigation ditches. Roadwork is being done along the entire route to get it ready for touring parties. Many carry camp outfits.



Western Union press operator tapping wire east of Williston, N. D., to get off rush message

Points were assessed as follows: A. A. A. touring car trophy: No. 20, Locomobile (Dr. J. D. Park), Perfect; No. 4, Premier (L. N. Fawkes), 5 points; No. 12, Velie (L. C. Erbes), 20 points; No. 18, Locomobile, (E. A. Everett), 380 points.

Entry No. 1 came as a non-contestant and the Stutz car was withdrawn for a broken crankcase. Summer resorters met the train at the hotel and gave a picturesque welcome.

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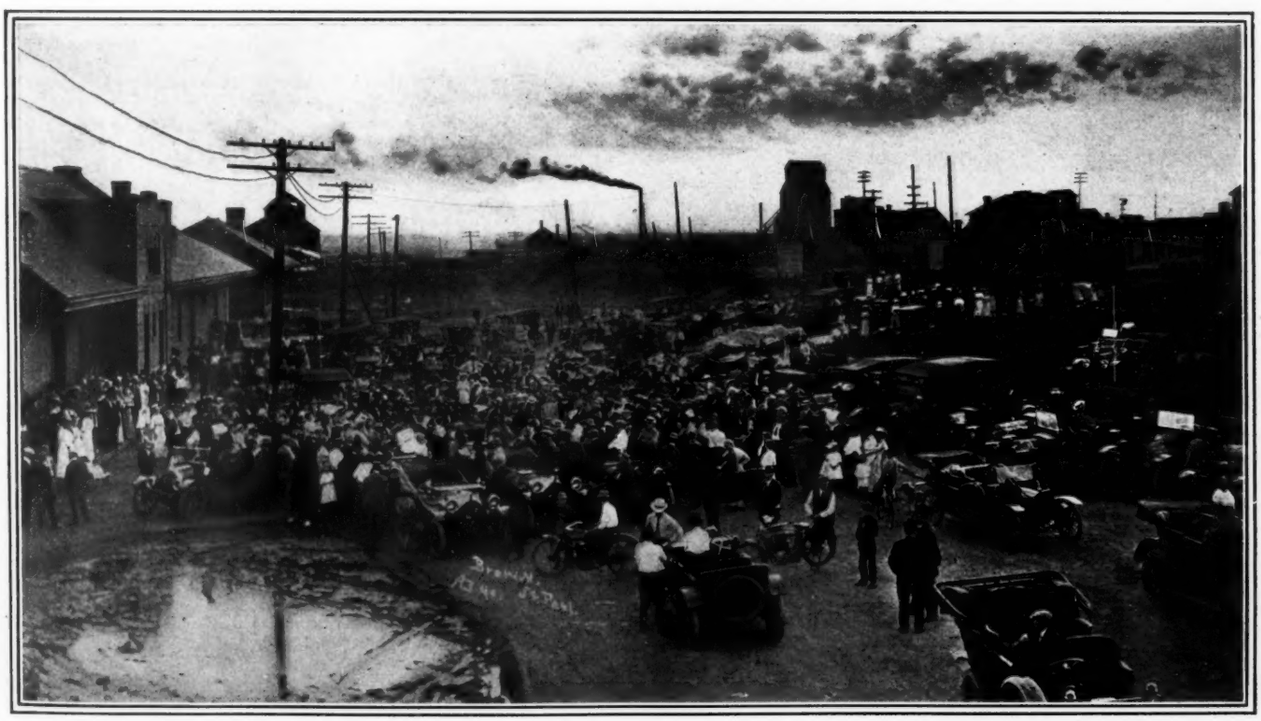
Ohio Road Exhibition Preparing

COLUMBUS, O., July 21—The Ohio Highway Commission, in charge of James R. Marker, has arranged for an extensive display of road-building machinery and materials to be made at the Ohio State Fair, which will be held in Columbus early in September. One of the largest buildings on the fair grounds will be used exclusively for the exhibit. The display will be in charge of Arch W. Smith, a deputy in the State Highway Commission.

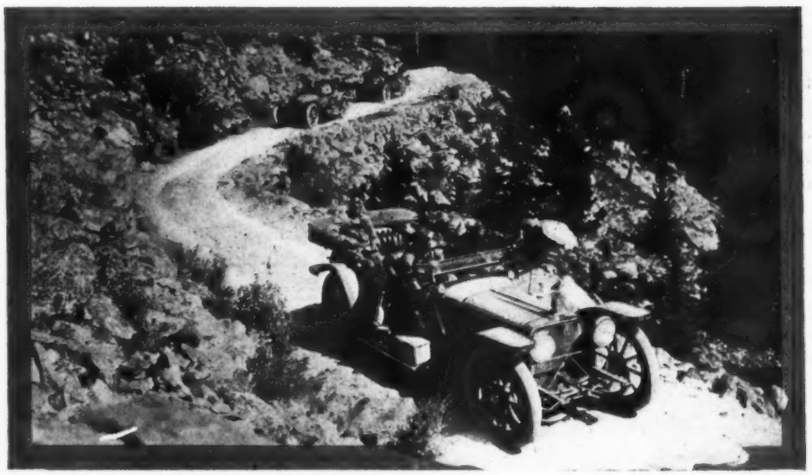
Much space has been contracted for by material men. One of the features will be the federal exhibit, which will contain various types of bridges and roads in miniature. Lectures will be provided to explain the most improved styles of road building.



The animated scene at the night control at Williston, N. D., during the A. A. A. Reliability Tour

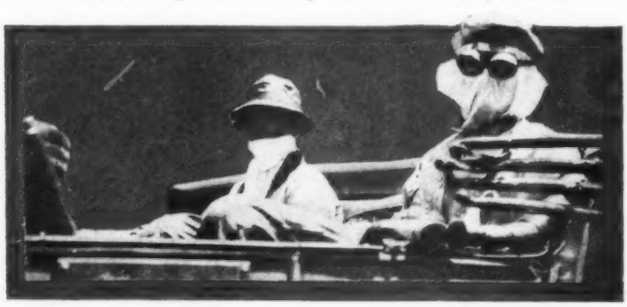
Indiana-to-Coast Tourists at Goldfield

GOLDFIELD, NEV., July 23—*Special Telegram*—The big Premier prairie schooner had not come in at eight o'clock today. It was last reported at Hot Creek, 110 miles out in the desert. The tourists were met at Hot Springs by the Tonopah Auto Club who had brought 150 gallons of gasoline for 90 miles for free distribution to the tourists. Eighteen cars of the twenty that left Indianapolis July 1 on their run to the coast reached Goldfield last evening. Two had fallen by the wayside but both are expected to catch up with the tourists before their journey's end at Los Angeles. Seventy miles out in the desert from Ely, Nev., while the Pathfinder was assisting one of the local escort cars out of an alkali sink a roller bearing on the driveshaft gave way. The passengers rode into Ely on the Premier schooner but a new bearing was not obtainable. A local car was sent out to assist Bob Spiegel, the driver, but he was forced to spend the night on the desert. The Brown truck again was held up by broken springs 50 miles from Cisco.



American car traveling over the Berthond Pass, between Denver and Idaho Springs

All the other cars are coming through with glittering colors, a thorough proof of their staunchness in view of the almost uniformly miserable condition of the roads through Utah. From the Colorado border, which was left 1 week ago, to the Nevada line crossed yesterday, there were no roads which were worthy of the name with the exception of about 40 miles around Salt Lake City. The trip across Utah took 5 days and covered 700 miles and every foot of the way was desert with the exception mentioned. This is not the fault of the Utah people but there are not enough of them to make an impression on the desert trails. Often the work of weeks of whole counties on a single bad piece of road would be found to have been undone by a cloudburst the night before the tourists passed. No greater energy could be displayed than that of the people of Price, Utah, who built an entirely new road through Price Canyon where only one car, Westgard's, had ever passed and that took several days. The new road let the tourists through in less than an hour but it is a mere shelf cut in the side of the cliffs, too narrow and with too sharp turns and narrow, steep grades to be negotiated with safety by the amateur. Where one drives 50 to 100 miles without seeing evidence of human habitation the desert and the mountain torrents play havoc with roads. Nevertheless, the scattered hamlets, a day's journey apart, exhibit the keenest interest in the tour and its dual objects, the cars and the Lincoln Highway. Bands, speeches, enthusiasm and bunting were the rule and the colors of the Midland Trail, gold and black, appeared wherever humanity could exist. Salt Lake City's scheduled stop of 2 days was shortened to 1 and the side trip to Ogden omitted because the tourists got a day behind in their schedule in the desert. Nevertheless there were baths at Saltair Bath, a pipe organ recital in the Great Mormon Tabernacle and a banquet. Sunday's run through the desert to Kearney's ranch, an oasis 150 miles from Salt Lake City, was a typical desert trip except that through an error in routing the tourists were sent over Dugway Pass, a grade that no car had attempted to negotiate in 3 years. It was a long grade averaging about 18 per cent. The sixes got over nicely but most of the fours had to be pulled or pushed. Tourists pitched camp in the rain. From the ranch a run of 125 miles was made to Ely, Nev., over the desert. However, almost as soon as the state line was crossed, some 25 miles from Water, roads got better and the last 50 miles saw the tourists making an average of 30 miles an hour. At Ely they were met by Governor Oddie, who will accompany them to the California line. Today's run all the way was over fine, hard roads through long, narrow stretches of desert between mountain ranges. At one point the desert was above the clouds. The silver mines of Tonopah and the gold of Goldfields were seen. Tomorrow we run to Big Pine, a distance of 70 miles. When a car is carrying two such distinguished personages as Ex-Mayor Bookwalter, chief spokesman of the tour, and Carl G. Fisher, the originator of the Lincoln Highway plan, it must needs be one that will be sure to get its passengers into control on the dot else one of the chief purposes of the tour, the boosting of the cement transcontinental motorway, would suffer. The Marmon has proved itself thoroughly equal to its task so far.



Pathfinder Daniels and a newspaper man veiled against alkali

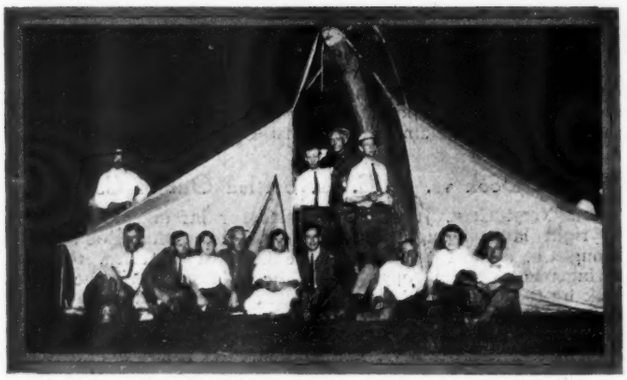
—

PRICE, UTAH, July 17—An oasis in the middle of the Great Desert of Utah, a veritable garden in a vast wilderness of bare cliffs and drifting sand, greeted the tourists as they drove into Price this afternoon after a run of 75 miles from Green River. All of the eighteen cars in tour from Indianapolis except the Brown truck are on hand and the latter has replaced its differential and is driving day and night to catch up. It was last reported at Grand Junction and probably will be with the rest of the Hoosiers as they leave Salt Lake City next Sunday.

Originally, Salt Lake City was scheduled as the stop for tonight. This would have necessitated a run of between 200 and 250 miles for the day, a feat almost impossible over these desert roads. This in conjunction with last night's delay for the seven cars held up by the cloudburst, determined W. McKay White, of the Marion factory, chairman of the tour, to shorten the distance and make Price the night stop. As it is, tomorrow's run to the Mormon metropolis will require a 6 o'clock start, if night driving is to be avoided.

Early this morning the twenty-five tourists marooned in the desert drove into Green River, where the more fortunate balance of the Hoosiers awaited them. The party then got under way for Price. Throughout the whole day's trip the Indianians threaded their way through the Midland Trail. This trail has in the last fortnight been worked by practically every citizen in the counties through which it passes until now every foot of the way is negotiable by automobiles, the small dry washes filled, the gullies and arroyos graded, the sagebrush and cactus scraped off and the surface dragged over nearly all of the 350 miles of desert between Mack, Colo., and Salt Lake City.

Yet, the desert is still a desert, and a waste such as only those who have crossed it can imagine. The roadbed is sand usually 3 or 4 inches deep, upon which the infrequent rains make little impression, for the water simply rushes down the gullies without soaking in and doing any good.



Contestants camping at Burlington, where a stop was made

Such was the road today and most of yesterday, and such must it ever be if the resources of the occasional inhabitants of the oases are to be relied upon wholly. The first water point, which means the first habitation of man, is the town of Desert, 13 miles westward from Green River. This is on the D. and R. G. Railroad, which is followed roughly most of the way. The town consists of a general store and a water tank. The water supplying the tank is pumped 5 miles from the Green River. The next water is at Woodside, likewise on the D. & R. G. Railroad. It has six houses and is 12 miles further. There is plenty of drinking water most of the time in the Price River, which runs through the town. This must be forded, however, and with caution, as if the direct line across the river is missed, the car will become mired down in quicksand, as happened to one of the cars which had to be pulled out by the Premier truck.

Big Spring ranch, which owes its existence and its name to a natural spring 25 miles to the west of Woodside, is the next point at which water bags and radiators may be filled. The spring is used for irrigation and the rancher has reclaimed possibly 60 acres of desert upon which he raises fruits and alfalfa. Some 22 miles further is a small town on the Price River. The land along the river is under irrigation and is raising fruits, alfalfa and desert hay in profusion.

Five miles further is Price, a town of some 5,000 people, with a business district, city hall, court house, high schools and other public buildings that would do credit to a city of ten times its size. It is almost wholly a Mormon settlement.

Smallest by far of any car in the run is the little Empire, and under the clever piloting of Joe Moore it is demonstrating its ability every inch of the way. Likewise the two Marions, the one a roadster and the other a touring car, under the guidance of Gager and Nichols, respectively, and carrying an unusual amount of excess weight, are checking in at controls with flying colors.

The two Haynes cars, driven by Wagner and Enders, are carrying some heavyweights in the way of celebrities in addition to the 5,400 pounds of total weight. In the one car is Elwood Haynes, inventor of the first American car; C. A. Branston, the English motor car engineer, while the other Haynes has as a passenger Senator Morgan of New York.

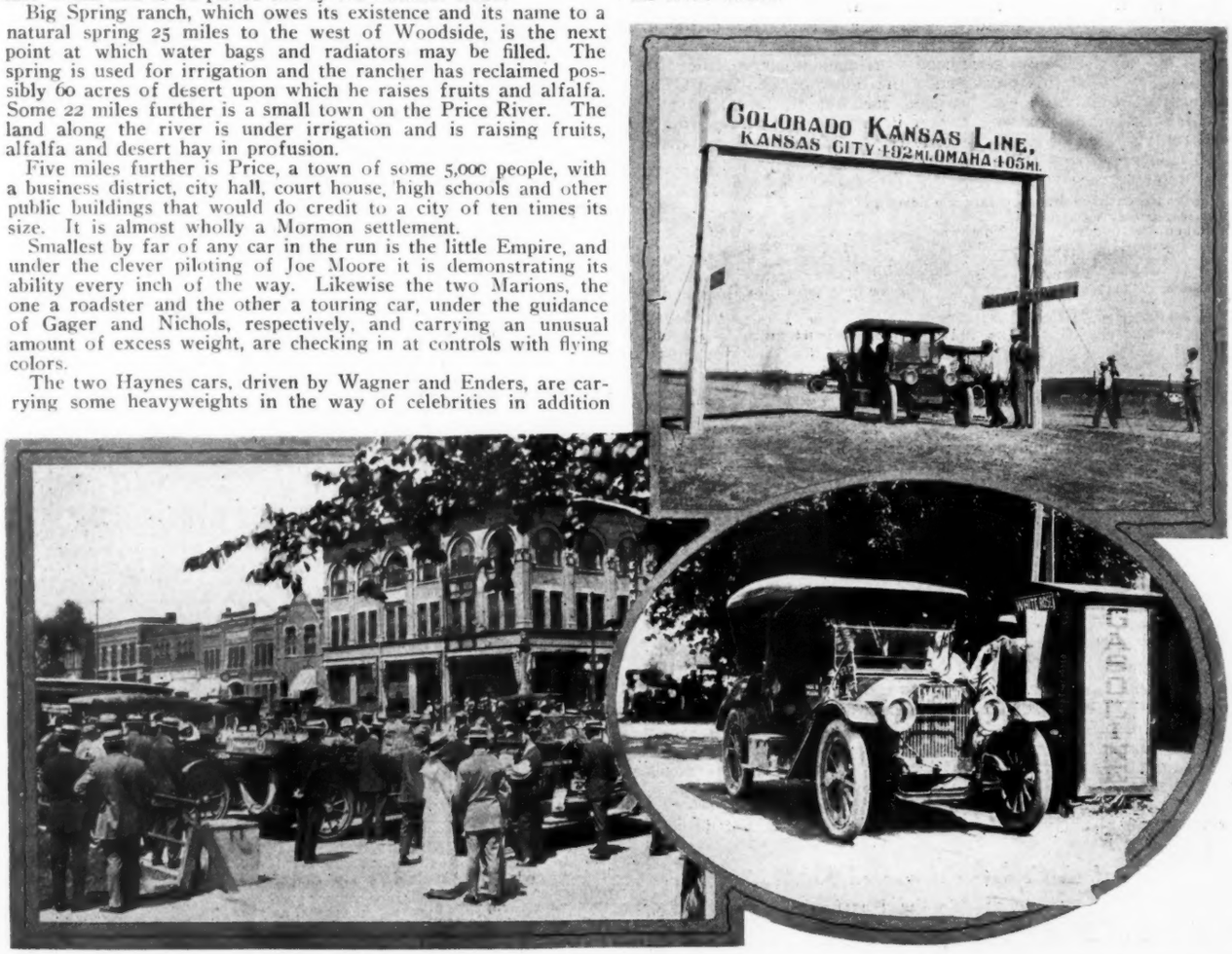
Likewise the two Appersons, with Max Winters and Nelson McLain at the wheels, credited with being the product of the two brothers who built the first American car, are slipping along the roads in an uneventful manner. The two Premiers simply are duplicating the records they have made in previous transcontinental runs. The one with Ray McNamara, the veteran cross country driver at the wheel, carries J. M. Ward, the secretary of the association. The other, piloted by Speedway Duncan, carries A. L. Westgard, America's most famous pathfinder. The Premier acts as pilot car, spreading the confetti for the rest of the cars and taking the bumps before putting out warning signs for those behind.

Underslinging as a factor of safety in transcontinental touring was given a practical demonstration when one of the Americans slid off a grade in the desert at an angle such that the passengers fell out. Its low center of gravity prevented the car turning over and it was brought back to the road without being capsized. The other proved that it had sufficient clearance for its job when it went to the running boards in the mud and got out as soon as traction was provided. The Americans are piloted by Charles Boyden and Edward Gouth.

The Pilot, with Russel Paar at the wheel, is pursuing the even tenor of its way without incident, accident or thrilling experience on which to hang a story. This is due not only to the staunchness of the car but to the skill of its driver, for whom transcontinental travel is no novelty.

The McFarlan six, too, is having a distressingly tame trip.

R. P. Henderson is demonstrating that he is as much a success as a road driver as he is at making and selling cars. He is putting his Henderson six across the country in fine style, only one forced stop of any importance being made so far and that was to bridge a washout in the road that occurred almost under his front wheels.



Left—Reception of contestants at Colorado Springs. Top—Empire car passing Colorado-Kansas state line. Right—At the Topeka, Kan., fuel station

For a Standardized Car

Convention Held by the Cole Company To Study Possibilities

INDIANAPOLIS, IND., July 18—"As applied to automobiles, there are two kinds of standardization. The first is mechanical standardization, and has been not only recognized but employed by automobile builders for years. Mechanical standardization merely means making all parts designed to perform similar functions in similar models precisely the same size and interchangeable. The car which is not mechanically standardized at the present moment has no chance of success. Practically all cars are mechanically standardized. There is no distinction in building a standardized car from a mechanical standpoint. The situation in this case is a negative one. You might put it this way: There is extinction if you don't build a mechanically standardized car—commercial extinction. It means a receivership.

"The thing we are interested in is not mechanical standardization. That phase of the subject is already being taken care of automatically. The new phase, and the one which we are now face to face with, is the subject of economic standardization. Economic standardization is the science of employing the factors of volume and overhead for the purpose of increasing quality and decreasing cost. As applied concretely to the motor car, standardization means building exclusively of nothing but recognized standard units. A standard part is any part which has been built so well that it has become the standard whereby all similar parts are measured.

"This is the first time in the history of the industry that a single car has been made out of 100 per cent. standardized parts. This is the first time that the best specialists in the world have been enlisted in the construction of such a car. The name of the first 100 per cent. standardized car is Cole." With these words Homer McKee, sales and advertising manager of the Cole Motor Car Co. of this city opened the 2-day convention of this concern, at which the standardized car was the sole topic of discussion. In addition to many of its agents from all points of the country being present, the Cole company had representatives of all concerns from which it purchases the various parts entering into its car.

The conference was a success from start to finish. Among the makers of parts represented were:

Timken Detroit Axle Co., Northway Motor & Mfg. Co., Mayo Radiator Co., Gemmer Mfg. Co., Spicer Mfg. Co., Detroit Steel Products Co., Hydraulic Pressed Steel Co., Janney-Steinmetz & Co., Firestone Tire & Rubber Co., Warner Instrument Co., Stromberg Motor Devices Co., Collins Curtain Co., Taylor Tire Pump Co. and Dayton Engineering Laboratories Co.

On Thursday night the whole party, numbering more than 200, went out to the Indianapolis Canoe Club and enjoyed a banquet given by the Cole Company.

M. A. D. A. Creditors To Get 16 Per Cent.

MILWAUKEE, WIS., July 21—It appears that creditors of the Milwaukee Automobile Dealers' Association, which conducted the Grand Prix, Vanderbilt, Pabst and Wisconsin motor trophy races at Milwaukee last October, will realize about 16 or 18 per cent. on their claims. Notice has just been issued by T. H. Spence, counsel for the M. A. D. A., that he is apportioning a fund *pro rata* and persons to whom the association is indebted had better set up at once and take their little share or go without anything.

Files Suit Against Maxwell Company

RICHMOND, VA., July 20—The Eastern Motor Sales Corp., of this city, has instituted suit for $13,000 against the Maxwell Motor Co., of Detroit, Mich., in the Law and Equity Court.

While no declaration has been filed, it is understood from General Manager R. B. Allport, of the Eastern Motor Sales Corp., that the suit was brought to recover damages suffered by his company, due to the failure on the part of the Maxwell Motor Company to deliver certain motor cars which it had contracted to supply between April 1, 1913, and the present date.

Hartford Company Awarded $30,572.76

NEW YORK CITY, July 21—To the Hartford Suspension Co., in its suit against the Westen Manufacturing Co., has been awarded damages amounting to $30,572.76, according to report of the Master, Henry D. Oliphant, who was appointed by the District Court of the United States and the District of New Jersey, following the favorable decision given the Hartford company in its suit against the Westen company for infringement of the Truffault-Hartford shock absorber patents.

The decision in favor of the Hartford company resulted in a permanent injunction restraining the Westen company from doing business of any kind, after which the Court appointed the Master to decide the amount of damages that should be awarded.

Blue Book vs. A. C. A. Settled Out of Court

NEW YORK CITY, July 22—The suit for infringement of the copyright laws, brought by the Automobile Blue Book Publishing Co. against the Automobile Club of America, for the infringement of the copyright in the publication of the Tour Book by the Club, has been settled out of court. In the settlement the club makes a substantial cash payment to the Blue Book, and withdraws its contemplated road book from publication for this year. The club also indorsed the Blue Book by the purchase of 1,000 copies for distribution among members.

Adamson Restricts Marshall Vulcanizer

INDIANAPOLIS, IND., July 21—The Adamson Mfg. Co., East Palestine, O., was awarded a temporary injunction restricting the Marshall Iron Works from making, selling, etc., of portable vulcanizing equipments which embody the features covered by the Adamson patents. Judge A. B. Anderson of the U. S. District Court, District of Indiana, rendered the decision.

Booth Studebaker General Manager

DETROIT, MICH., July 22—Clarence H. Booth has just been appointed general manager of the automobile division of the Studebaker Corp. During the past 4 years the number of men under his supervision grew from 1,000 to 14,500.

INDIANAPOLIS, IND., July 21—The city of Indianapolis and the Hoosier Motor Club have brought a test case to test the right of the city to charge an annual motor license fee under the new state license law, which specifically prohibits any motor fee other than that collected by the state. The city contends this feature of the state law is invalid.

Automobile Securities Quotations

Changes in stock prices were few and of little import, and were the effect almost entirely of actual trading. Firestone, Alco and Consolidated advanced, while Goodyear common suffered a loss of 20 points.

	1912 Bid	1912 Asked	1913 Bid	1913 Asked
Ajax-Grieb Rubber Co., com	120	..	145	160
Ajax-Grieb Rubber Co., pfd	..	100	94	100
Aluminum Castings, pfd	100	..	97	100
American Locomotive Co., com	42½	43½	30	30¼
American Locomotive Co., pfd	108½	109	101	102
Chalmers Motor Company, com	..	..	105	112
Chalmers Motor Company, pfd	..	..	98	102
Consolidated Rubber Tire Co., com	12	14	14	18
Consolidated Rubber Tire Co., pfd	..	59	64	75
Firestone Tire & Rubber Co., com	275	285	275	281
Firestone Tire & Rubber Co., pfd	105	107	103	105
Fisk Rubber Company, com	..	..	..	..
Fisk Rubber Company, pfd	..	..	..	100
Garford Company, preferred	99	101	85	95
General Motors Company, com	33	34	27⅞	29¼
General Motors Company, pfd	76	77	73	74½
B. F. Goodrich Company, com	75	76¼	29	30
B. F. Goodrich Company, pfd	108½	109	90⅞	92
Goodyear Tire & Rubber Co., com	298	304	310	316
Goodyear Tire & Rubber Co., pfd	103	105	98½	99½
Hayes Manufacturing Company	..	97	..	90
International Motor Co., com	22½	25	3	5
International Motor Co., pfd	83	85	18	25
Lozier Motor Company, com	..	..	15	20
Lozier Motor Company, pfd	..	..	..	90
Maxwell Motor Co., com	..	..	2¾	3½
Maxwell Motor Co., 1st pfd	..	..	24	26
Maxwell Motor Co., 2nd pfd	..	..	6	8
Miller Rubber Company	145	150	133	137
Packard Motor Company, pfd	105	106½	98	102
Peerless Motor Company, com	..	..	45	50
Peerless Motor Company, pfd	..	..	..	96
Pope Manufacturing Company, com	30	31	9½	10¾
Pope Manufacturing Company, pfd	73½	74½	28	33
Portage Rubber Co., com	..	..	..	45
Portage Rubber Co., pfd	..	..	..	90
Reo Motor Truck Company	8¾	10	9	11
Reo Motor Car Company	21	24	19	21
Rubber Goods Mfg. Co., pfd	..	..	100	110
Studebaker Company, com	31½	33	23	25
Studebaker Company, pfd	94	95	82	86½
Swinehart Tire Company	96	99	85	88
U. S. Rubber Co., com	..	..	60½	60¾
U. S. Rubber Co., 1st pfd	..	..	104	104½
White Company, preferred	107½	108	102	104
Willys-Overland Co., com	..	..	56	62
Willys-Overland Co., pfd	..	..	84	90

Maxwell Buys Plant

Correja Brings Out a New Six—Lamb To Head National Truck

INDIANAPOLIS, IND., July 22—Within the last few days Jonathan D. Maxwell, formerly with United States Motor Co., has filed a deed in Indianapolis covering his recent purchase of the plant formerly operated by the T. B. Laycock Manufacturing Co. The purchase was made from the Pittsburgh Manor Co., Pittsburgh, Pa., which bought the property at receiver's sale. Mr. Maxwell paid $350,000 for the property, which includes an enormous factory building and 40 acres of land. He is now organizing a company for the manufacture of motor cars, and it is thought manufacturing operations will start within the next few weeks.

Pelletier Buys Flanders Electric

DETROIT, MICH., July 21.—E. LeRoy Pelletier has purchased the plant of the Flanders Electric Company, together with the equipment and the stock on hand, and will organize a company to manufacture the Flanders electric. The name of the company is to be the Tiffany Electric Car Company. Mr. Pelletier will continue to direct the advertising of the Flanders company. Active charge of the new concern is assumed by Don C. McCord.

New Correja Has Six Cylinders

NEW YORK CITY, July 22—Vandewater & Co., Elizabeth, N. J., have announced a six-cylinder Correja car. This vehicle has a 3.5 by 5-inch motor, cylinders cast in a block, with valves arranged in T fashion. The three-speed gearset is carried on ball bearings on the rear axle. The other mechanical features are along the line of Correja experience. The body is a five-passenger touring type suspended on three-quarter elliptic springs.

Laub President National Truck

FINDLAY, O., July 21.—Frank E. Laub, of Lima, O., formerly of Bowling Green, where he promoted the Gramm Motor Truck Co. prior to its removal to Lima, has been elected president and general manager of the National Motor Truck and Mfg. Co., of Gibsonburg, capitalized at $25,000, with $100,000 stock issued. Other officers of the company are: A. T. Crossett, first vice-president; C. H. Hutchinson, second vice-president; John O'Leary, Toledo; attorney, secretary, and J. A. Nieset, Gibsonburg, treasurer. The company will manufacture 1 and 2.5-ton trucks.

Federal to Start Manufacturing

MILWAUKEE, WIS., July 21—The Federal Pressed Steel Co., of Milwaukee, expects to be able to commence operations of its big plant now under construction at Keefe avenue and North Pierce street, on August 20 or September 1. In preparation for the commencement of work, the company has increased its capital to $150,000 and made important additions to its staff.

INDIANAPOLIS, IND., July 22—A new company has been organized at New Albany, Ind., to operate the plant formerly operated by the American Automobile Co. of that city, which has just gone through receivership proceedings. The new company, known as the Falls Cities Motor Co., has been organized by O. E. South, who was treasurer of the American company, and has been incorporated with $50,000 capital stock. Others interested in the new company are Ferdinand L. Kahler, Sr., Archie E. Brock and George R. Elder.

Koehler to Handle Grant in East

NEW YORK CITY, July 21.—The H. J. Koehler Co., New York City, will act as the eastern distributor for the new Grant car. The new cars are expected to be on the floor during the latter part of August and everything will be in readiness at that time for quick deliveries. The Koehler company has been particularly fortunate in the small car field, having had great success with the Hupmobile for the past few years. The new Hupmobile distributor has not as yet been announced. A full description of the Grant car appeared in THE AUTOMOBILE of June 26.

President Wilson Indorses Good Roads

WASHINGTON, D. C., July 23—*Special Telegram*—A conference of importance to the national road movement was held at the White House yesterday at which President Wilson received a committee from the American Road Congress to be held in Detroit, September 29 to October 4. The president told the delegation that press of official business would prevent his attendance, but he gave substantial and cordial evidence of his interest in the road movement. He indicated his willingness to prepare an address to be read at opening of the congress and to have the administration represented by a member of the cabinet.

New York Mail Drivers Not to Strike

NEW YORK CITY, July 21—The mail wagon drivers of the N. Y. Mail Co. withdrew their demands for shorter hours, higher pay and paid-for overtime work as soon as President Murry of the concern told them that the company had been losing $500,000 under the execution of its present delivery contracts with the N. Y. Post Office. Their demand was for $3.75 per man instead of $3 a day, a 10-hour day instead of 12-hour period, time-and-a-half pay for overtime up to a 12-hour stretch and double pay after that, and a full dinner hour for each man.

New Car To Be Made in Flint

FLINT, MICH., July 23.—A new passenger car is soon to be added to the growing list of Flint-made motor vehicles. This car is being fathered by the well-known Durant-Dort Carriage Co. interests. Although a separate company is being formed, the personnel of the organization will be practically the same as that of the parent company. The car is to be equipped with a four-cylinder motor and will sell at between $1,000 and $1,200.

Drivers Discussed at Motor Truck Club

NEW YORK CITY, July 17—At the July meeting of the Motor Truck Club of New York City held at the Hotel Cumberland last night, a new line of endeavor was brought to light, along which the efforts of the organization, it is thought, can work much weal. The topic of the evening was "Motor Truck Drivers, Their Virtues and Their Shortcomings," and was preliminary to what is expected to be a vigorous campaign toward the education of motor truck owners and drivers.

George H. Pride, of the Heavy Haulage Co., was the first speaker. His experience showed him, he related, that a driver who is often humored in small things will be found more willing to co-operate with the plans of the owner than he whose individuality, self-esteem, and common sense is altogether set aside by his employer. It was Mr. Pride's opinion that drivers should be permitted to operate but one car, and to have exclusive use of that one. He said that the driver problem cannot be discussed intelligently without making the distinction between the driver in a large fleet of trucks and the one who is employed by the owner of two or three vehicles.

The meeting was attended by about forty members. The next meeting will be held at the grounds of the Marine Field Club, Gravesend Bay, L. I., in the form of an outing.

Market Changes of the Week

This week's markets saw few changes. Copper rose $0.00 1-4 a pound, developing a stronger tone. Lead was quiet but firmer, closing at $4.35, a gain of $0.02 1-2 per pound. Tin was again strong and higher, in sympathy with the higher prices abroad. Tin sold here at $41.25 per 100 pounds, a gain of $1.45. Domestic scrap rubber remains steady. The demand from reclaimers is rather slow and the exports recently have been light. Cotton-seed oil made new high records on Wednesday, with the market in some respects showing sensational features. The advance on Wednesday of $0.24 per barrel was due solely to the fact that oil is scarce so far as its availability for market purposes is concerned, closing at $9.27.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Change
Antimony, lb.....	.07½	.07½	.07½	.07½	.07½	.07½	.....
Beams & Channels, 100 lbs.....	1.61	1.61	1.61	1.61	1.61	1.61	.....
Bessemer Steel, ton	26.50	26.50	26.50	26.50	26.50	26.50	.....
Copper, Elec., lb..	.14⅛	.14¼	.14¼	.14¼	.14¼	.14⅜	+ .00¼
Copper, Lake, lb..	.14½	.14⅜	.14⅜	.14⅜	.14⅜	.14½	.....
Cottonseed Oil, lb..	9.03	9.10	9.15	9.19	9.20	9.27	+ .24
Cyanide Potash, lb.	.19	.19	19	.19	.19	.19	.....
Fish Oil, Menhaden, Brown...	.33	.33	.33	.33	.33	.33	.....
Gasoline, Auto, 200 gals.....	.22¼	.22¼	.22¼	.22¼	.22¼	.22¼	.....
Lard Oil, prime..	.95	.95	.95	.95	.95	.95	.....
Lead, 100 lbs.....	4.32½	4.32½	4.32½	4.32½	4.32½	4.35	+ .02½
Linseed Oil.....	.49	.49	.49	.49	.49	.49	.....
Open-Hearth Steel, ton.....	26.50	26.50	26.50	26.50	26.50	26.50	.....
Petroleum, bbl., Kansas crude...	.93	.93	.93	.93	.93	.98	+ .05
Petroleum, bbl., Pa., crude.....	2.50	2.50	2.50	2.50	2.50	2.50	.....
Rapeseed Oil, refined	.68	.68	.68	.68	.68	.68	.....
Silk raw Italy.....	....	5.00	....	....	5.00	5.00	.....
Silk, raw Japan.....	.....	3.90	....	....	3.87½	3.85	— .05
Sulphuric Acid, 60 Baume.....	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.....	39.80	39.80	40.10	40.25	40.50	41.25	+1.45
Tire, scrap.....	.09½	.09½	.09½	.09½	.09½	.09½	.....

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Higher Oil Pressures

ONE year ago, when it was announced that a leading French builder of racing cars had used an oil pressure of nearly 200 pounds to the motor bearings, the information was treated with incredulity, many engineers considering that such a pressure was highly unnecessary. In the Grand Prix race, several motors had pressures of 200 pounds to the crankshaft and connecting-rod bearings. From the methods adopted by the French in preparing their cars for races, it is certain that they devote the greatest attention to lubrication details, going so far as to change the entire oil supply in a motor a short time before the start of the race. With other entrants the lubrication has become so important a factor that oil refiners have been asked to prepare oils specially suited for the temperatures at which different motors work.

If lubrication is so all-important with racing cars its importance cannot be lost sight of in touring cars and commercial vehicles, where relatively low-speed motor work is the rule. True, several makers are giving it attention. Some who a few years ago pinned all their faith to splash systems have now adopted the positive forced-feed system to all engine bearings. More will have to follow in this path.

Oil economy, which has never entered the minds of many makers, will be forced upon them in a few years, just as fuel economy is now being forced upon the foreign manufacturer.

Two Speed Axles Are Coming

IT is surprising that two-speed axles giving direct drive on the two higher speeds have not come into more general use before this, because they were on a prominent American machine 6 years ago but were dropped from that date until a year ago when another maker fitted them. The two-speed axle is more needed today than ever before, first because cars are being made heavier and motors smaller, and second because fuel consumption is being given more consideration than ever before.

There is need for greater fuel economy, as many cars are entirely too extravagant on fuel. The reduction in motor dimensions tends to reduce the fuel consumed, but the added weights place a handicap on it. The two-speed axle used in conjunction with a three or four-speed gearbox will give all the speed variations that present road conditions demand.

The two-speed axle is most necessary in level, as well as in hilly countries, and it is particularly necessary where there is much driving in cities and also in the open country. Hosts of cars are driven 90 per cent. of the time in the city, others 90 per cent. of the time in the open, and both have the same gear ratio. With city driving at 15 miles per hour and country driving around 25 or 30 miles per hour it is certain that in both cases the motor cannot be operating within its range of maximum efficiency. If its efficiency range suits the city field then it does not suit the country situation so well and vice versa. The two-speed axle meets these requirements and gives each owner direct drive. Not only will the motor have a longer life, but the wear and strain on all of the other parts of the car will be correspondingly reduced.

For hilly countries there is ample necessity for two direct drives as afforded by the two-speed axle. In many states there is entirely too much second-speed work on hills which is made necessary by the bad approaches and the frequent rough bridge where the ascent begins. Some drivers will rush the rough approach and the rough bridge at the expense of tires and the car in general, many prefer to practically slow down and make the hill on second or perhaps low.

The value of the two-speed axle becomes more apparent also because of the more general use of high-speed, smaller-sized motors. With these motors it is essential to keep the speed well up on the hills as, if it drops, low gear will have to be brought into use. The two-speed axle will offer double opportunity in such work.

In level country touring the two-speed axle will give relatively high touring speeds with a small motor without continuous high racing.

In these days of innovations and quick transitions it is questionable if the two-speed axle, now that it has been announced by the Cadillac company, will not be taken up with avidity; true it will not come with a landslide like the self-starter, but in the form of a sure and certain movement. The introduction of worm-drive by a few concerns and its more general use abroad will conflict somewhat, as a two-speed construction would be impossible with worm-drive. The gradual growth of the movement will be watched with interest.

Is Engine Power Affected by Atmosphere?

Paper Read Before the Society of Automobile Engineers and the Institute of Automobile Engineers by Herbert Chase

Herbert Chase

THE purpose of this brief paper is to place in your hands a limited amount of data with respect to variations in the power of a motor due to atmospheric changes, with a view to provoking further discussion of the subject and inducing others to submit definite data which will settle what is now a moot question.

The writer frequently hears the assertion that automobile motors run better at night than in the daytime and develop considerably more power, as evidenced by the fact that hills which a car will not take on high gear during the day can be climbed without difficulty on top speed at night. Just how much of this is mere fancy which can be laid to some psychological phenomena affecting the driver of the car, and how much has some basis in fact, is a question which has never been satisfactorily answered so far as I am aware.

During the past month there was conducted in the laboratory of the Automobile Club of America under my general oversight a test of a Packard motor. This motor ran continuously with the throttle wide open for a period of 300 hours. The speed was maintained as nearly constant as possible by making slight variations in the load. During a majority of this time the doors and windows of the laboratory were wide open, so that there was no marked difference between the atmospheric conditions inside the room and out of doors. If then the night air is productive of beneficial effects upon the power which a motor develops there was every opportunity for the difference to show itself. I have therefore averaged the power developed over a period of 4 days and find a difference of less than 1 per cent. as between the average power from 6 a. m. to 6 p. m. and that from 6 p. m. to 6 a. m. on these days, the slight difference being in favor of the day rather than the night periods. The difference, in fact, is very much less than that occurring between many successive 15-minute intervals.

Just why a motor should develop more power at night, if it be true that it does so in some cases, is a question which I am unable to answer to my satisfaction. The ordinary changes in temperature and in the quantity of water vapor present in the air may have some slight effect, but it hardly seems probable that they result in changes of power sufficient to be detected save by the most sensitive dynamometer.

Marked changes in barometric pressure do have an appreciable effect upon the power output of a motor, however, and this fact can be readily demonstrated by a very simple experiment. The data given below shows clearly what change resulted from definite variations of this character. The experiment was performed as follows:

The carbureter used on the motor to be tested was inclosed in a box which had but one opening to the atmosphere. To this opening was connected an expansion chamber and a Venturi air-meter with a 2-inch throat. Attached to the inlet of this meter was a 2-foot length of 3-inch pipe. Near the outer end of the latter an ordinary butterfly throttle (designated "Throttle A" below) was inserted. A mercury manometer was connected to the box containing the carbureter in such manner as to measure the drop in pressure of the air entering the carbureter.

The throttle above the carbureter was fastened wide open and the spark was adjusted for maximum power in each run.

Three runs were then made at each of four different speeds, namely, 400, 800, 1,200 and 1,600 revolutions per minute, approximately. The first run at each speed was made with throttle "A" wide open, and note was made of the drop in pressure at the carbureter, due to friction in the air line. For the next run throttle "A" was partly closed until the pressure of the air entering the carbureter was reduced by about 1 inch of mercury below the previous reading. A third reading with throttle "A" closed to give a drop of approximately 2 inches of mercury was then made. In each instance the load on the motor was reduced sufficiently to maintain the same speed as for wide throttle. The temperature of the water entering the motor was held substantially constant, as was also the temperature and humidity of the entering air.

The effect of partly closing throttle "A" gives practically the same conditions as a decrease in the barometer reading. The loss of power at 1,600 revolutions per minute due to a drop of 1 inch of mercury was approximately 5 horsepower in 71, or 7 per cent., while a 2-inch drop doubled the loss. At 1,000 revolutions per minute the losses were about 3.5 and 6 horsepower, respectively, in 31 horsepower, or about 11 per cent. and 19 per cent.

In closing, permit me to say that I hope you will feel free to criticize the opinions expressed in this paper.

Discussion

Among the points raised by the paper, Mr. Chase was asked how large a box was used to inclose the carbureter. He stated that it had a cubical content of 1 cubic foot and was connected to an expansion chamber of 5 cubic feet. Mr. Grant spoke of tests which he had made during the flood time when the barometer varied from 30.1 to 28.6 inches of mercury. He used a carbureter with no air valves or springs and with readings varying from 200 to 1,600 revolutions per minute. The horsepower varied with the barometer. He computed a variation of from 5 to 14 per cent. in horsepower per inch of mercury as compared with the standard barometer reading of 30 inches.

C. H. Taylor touched upon night running and cited some experiments which he had made 8 years ago to show that apparent increases of humidity have no effect on running. He found that with weak mixtures the power increased with the humidity as much as 18 per cent., but that with correct mixtures there was no effect of humidity changes. The humidity effect was not a natural one but was obtained by the injection of steam into the carbureter air intake.

Mr. Chase suggested that possibly the popular impression of power increase may be due to the fact that people are inclined to confuse the ability of a car to accelerate rapidly with increase of power.

Machine Detects Over-Supply of Oil

Takes Pictures of What Is Happening Within Cylinder Walls—Shows the Amount of Free Carbon Present

IF you were to ask the manufacturer of your motor how he determined the condition of lubrication in the cylinder of his machine he would undoubtedly reply that there were several ways of judging as to the amount of oil passing to the cylinder and whether or not that oil was doing satisfactory work. He might advise that the best way would be to wait until the end of a four or eight-hour run and then dismantle the motor to find out the conditions. This, of course, would reach the true state of affairs, but there is another way.

The Texas Company of New York and Houston, in connection with the development of motor oils have realized the necessity of an instrument which would give, in a graphic manner, a picture of what was taking place inside the cylinders. They have originated and designed the instrument, illustrated in Figs. 1 and 3, by the use of which explosion pictures can be made, illustrating on as nearly a scientific basis as possible, conditions in the cylinders, in a somewhat remarkable manner.

A certain standard sized pet cock is screwed into the opening above the cylinder or exhaust valve and the instrument firmly clamped in position. In the holder is placed a piece of heavy, partially absorbent paper in a proper position to receive the gas as it blows through the pet cock. In practical use a record is made of a certain number of explosions. Should there be any excess of lubricating oil getting up by the rings, it will show on the paper. Should there be no lubricating oil whatsoever the paper will indicate the heat from the explosion. Should the oil which gets up past the rings be turned to carbon this also will show.

Here are shown several explosion pictures, as taken by this instrument on a four-cylinder motor, each picture the result of twenty explosions. The darker pictures, which were taken first, show very plainly that too much oil was getting into the cylinder and that there was an excessive amount of carbon present, due to the burning up of the oil, which had leaked beyond the piston rings. The light circle surrounding the heavy center was produced by the throwing off of some of the explosion, due to the force of contact. As this motor was of the splash type the regulation of the amount of oil supplied to the cylinders was reduced by plugging the overflow in the crankcase and making a new one 3-16 of an inch lower, thus establishing a new oil level, with a decrease in the amount of oil thrown up by the connection rods, etc.

Fig. 1—View of the Texas Company's machine for taking explosion pictures

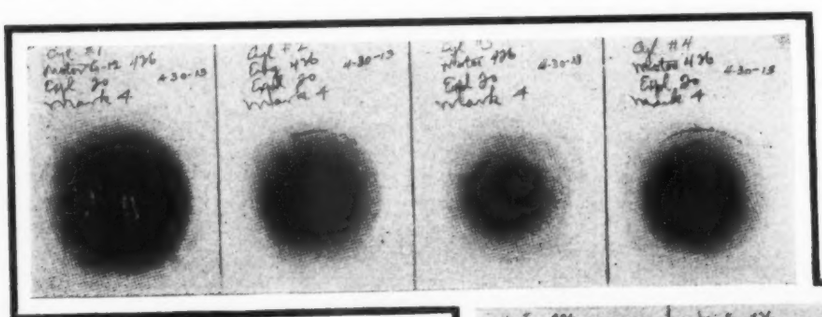
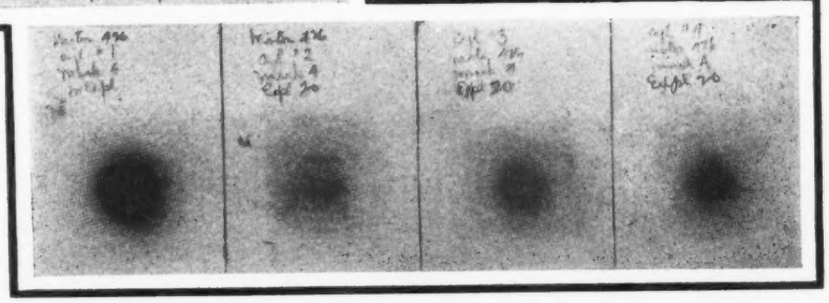
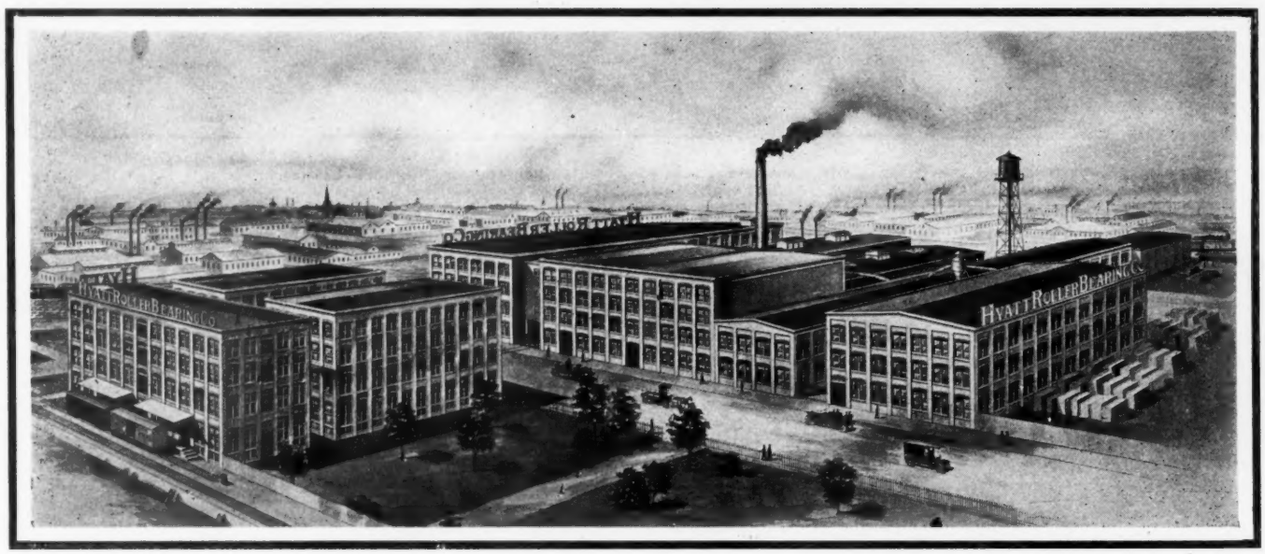


Fig. 2—Upper—Showing the dark explosion pictures as produced by the machine before the supply of oil to the cylinder was regulated. The necessity of regulation, especially in the first cylinder, is clearly shown by the heavy spots



Lower—After the supply of oil is regulated by cutting down the amount splashed to the cylinder, the explosion spots appear much fainter and clearly show the value of the use of the instrument. The first cylinder still gets the most oil

New Hyatt Plant Covers Two Blocks



View of the plant where the Hyatt Roller bearings are manufactured, located at Newark, N. J.

AN idea of the magnitude of the Hyatt Roller Bearing Co.'s works at Newark, N. J., may be obtained from the accompanying illustration.

The plant covers about two square city blocks and is so situated that the company have a railroad outlet on five trunk lines, all of which pass through the immediate vicinity. Nearly 1,000 men are employed.

Perhaps the most interesting part of the Hyatt Roller Bearing Co.'s works is the extensive manufacturing organization.

Fig. 3—View of the machine for detecting lubricating ills

The entire plant is electrically driven, the engine equipment consisting of three direct-driven units of 1,000 horsepower total capacity. A 500-horsepower producer equipment furnishes gas for manufacturing purposes. Steam is supplied by six 200-horsepower boilers.

The company maintains an analytical laboratory which is equipped with all the necessary apparatus for the analysis of iron and steel, as well as coal, oils, gas and miscellaneous items, the standardization of which has been advisable. Samples of all incoming materials are subject to analysis.

A physical laboratory equipped with a 50,000-pound Olsen testing machine is also an important feature of this plant. Incoming material must pass the physical test as well as the analytical before it is accepted.

The experimental department is under the supervision of an engineer of wide experience who has been identified with Hyatt products since the beginning of their development.

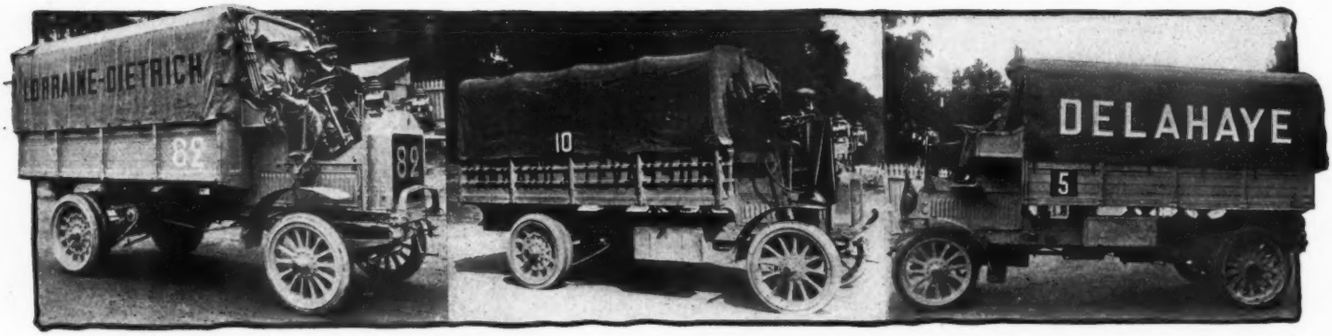
In one of the roller cutting departments sixty-five metal cutting band saws are required. Over 150,000 rollers have been handled through the various roller cutting departments in a single working day of 10 hours.

A battery of seventy-five small automatics, ranging in capacity from 0.5 inch to 1 inch, provides the necessary small parts, such as pins, rollers, etc.

Grinding is a very important factor on account of the nature of the product. The department devoted to plain grinding consists of about seventy-five machines. The internal grinding department consists of 100 specially designed internal machines. About sixty automatics are required, ranging in capacity from 2 to 6 inches.

The milling department is devoted almost exclusively to shafting products. The boring department is devoted exclusively to shafting.

Complete testing work which is necessary in the manufacture of roller bearings in which the limits worked to are so small has been arranged for in the large testing department which is run under the supervision of the manager of the experimental department. Tests are both physical and chemical.



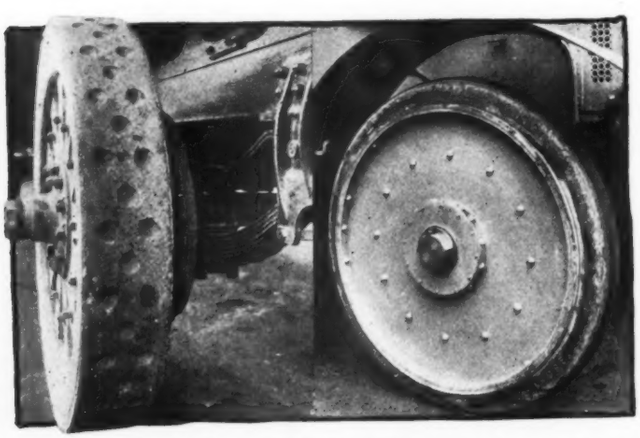
Three chain-driven trucks in the trials. Left, Lorraine 3-ton. Center, 20-horsepower Panhard-Levassor. Right, 3-ton Delahaye

70 Trucks Compete in French Army Trials

Subsidy of $520 and $240 Annual Upkeep Allowance Granted to Each 3-Ton Vehicle Meeting Military Requirements

PARIS, July 14—France is in the midst of her annual military automobile truck competition, the most important commercial vehicle competition of its kind in France and probably in Europe. The primary object of the competition is to prove what models are suitable for army subsidies. Seventeen manufacturers have entered seventy vehicles, representing thirty-five distinct models, and these are to be tested on the road for a full month, covering a total distance of about 2,500 miles. They have all essential parts sealed, fuel and lubricating oil are controlled, and at the end of the road test there is a thorough examination, some of the machines being entirely dismantled. Those machines having fulfilled all the requirements of the competition, particularly as regards average speed, reliability, economy and endurance, are accepted as army types and can be sold with the advantage of the army subsidies, equalling $520 at purchase and $240 upkeep allowance for each of the 4 years the vehicle is in operation. This subsidy applies to a truck carrying a useful load of 3 tons. To assure absolutely stock vehicles being entered, the army authorities visit the factories and stamp the various parts at an early stage of manufacturing.

These trials date back to 1897, when they were organized by the Automobile Club of France. In 1909 the military authorities took them over and inaugurated the present subsidy scheme. Their popularity is shown by the fact that in 1909 there were fifty-four competitors; twenty-eight in 1910; forty-eight in 1911; sixty-two last year, and seventy in the present competition. Quite apart from the subsidy scheme, the trials are of value as a demonstration of the value of modern trucks, and as a high water test in which prospective purchasers have the fullest confidence. The army has no preferences; it has plenty of time, money and men to carry out most exacting and carefully conducted tests, and the public realizes that if a truck has received the stamp of approval of the French army it can be relied on for commercial work. The trials are closely watched by commercial vehicle users, increased business invariably following the trials, although the purchasers may not be particulary interested in securing the subsidy.



Left, steel-shod wheels and double spring suspension on Aries. Right, rubber-shod disk wheels of Bayard-Clement truck

The main features of the trials remain as last year. Trucks carrying a useful load of 2 to 3 tons are admitted. In the past it has been the practice for 3-ton trucks to carry a useful load of 3.5 or 3.75 tons, an increased subsidy being granted for the extra amount. This year no extra subsidy is given for amounts over 3 tons. The change has met with dissatisfaction, for it is felt that if a truck is capable of carrying an overload with safety—the dead weight remaining within in fixed limits—the manufacturer ought to have the advantage of that extra load. Vehicles taking more than a 3-ton load must go in the tractor class, in which the tractor can carry 3 tons and the remaining load be aboard one or two trailers. A third class is for four-wheel drive vehicles with trailers. This is entirely new class and is one that will be encouraged by the French war department. Next year there will be a special competition for this class of vehicle, and this year's class can be considered as a preliminary. It is felt that for army work, and particularly for hauling heavy artillery and for taking ammunition and supplies right to the fighting line, a four-wheel drive vehicle has decided advantages over the ordinary type.

All competitors in these trials must be able to run on gasoline, benzol and alcohol without change of carbureter. This is done to guard against any possible shortage of fuel in time of war. Average speed on long journeys has been increased from 7.4 to 9.3 miles an hour. This is really an attempt to get rid of trucks shod with steel tires. As trucks with steel tires have not been as successful in actual work as was expected, the competition has been made more severe by increasing average

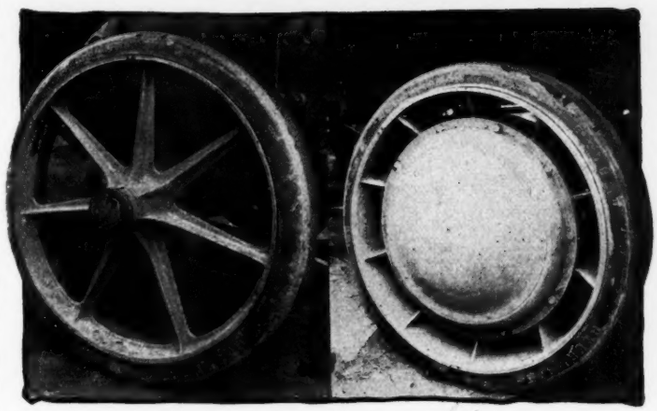
speed. If the trucks stand up under these conditions they will be accepted; if not, they will have to go out. As a consequence of this increase in the speed average most manufacturers have preferred to withdraw their steel shod models. The only exceptions are Aries, with one type having steel bandages, and the front-drive Latil. This latter is an exceptional case, for the whole of the mechanism is over the front wheels, which are shod with double rubber tires.

The advantage which steel tires enjoyed has dwindled away by reason of improvements in rubber tires and the consequent lower cost of upkeep. Two or 3 years ago a tire guarantee of 6,000 miles, with restrictions as to speed and weight, was rather difficult to obtain, and in practice the life of a solid rubber tire was not much more than 5,000 miles. At the present time the French army trucks show over 20,000 miles with standard sizes of rubber tires, and the Paris General Omnibus Co. is being able to get 30,000 miles from tires before they are scrapped. With these improvements, rubber shod trucks have an upkeep cost as low if not lower than that of steel shod vehicles, while the possibility of breakage through vibration is decidedly decreased. All tires are of continuous band type. Block rubber tires are not used.

Correct suspension plays an important role in the life of tires and mechanism. Where steel tires are still used the greatest care is taken with suspension. The Latil 3-ton truck with steel tires at the rear has long semi-elliptic springs at the rear with a width of 5.5 inches. The face width of the steel tires is 6 inches. This machine carries nothing over the rear axle, the motor being in front and the front wheels being both drivers and steerers. The Latil has a special type of coil spring shackle which must contribute in no small degree to easy suspenion. The shackle pin is received in the two arms of a yoke having a stem carrying a stout coil spring, the spring and stem being contained within a hanger on the frame member. The tension of the spring can be adjusted and means are provided for maintaining a quantity of lubricant in the housing.

Aries, with the only other type of vehicle using steel bandages, makes use of two sets of springs. The main springs, seated under the dead axle—the truck is a chain-driven model—having eight leaves of 4 inches width; the auxiliary springs mounted above the axle have five leaves and the same width. The auxiliary springs are not shackled. They are brought into play when a load is being carried; when running light the main springs only are in operation. The steel bandages on the Aries have diagonally placed rows of hollows on their circumference with a view to preventing skidding.

Renault, with a tractor carrying a useful load of 5,700 pounds, and having 4 tons useful load on two trailers, total weight of the tractor being 16,000 pounds, uses semi-elliptical springs at the rear of his tractor with a width of 5.375 inches. The front springs of the same vehicle measure 3.25 inches across, and the practically flat springs of the trailers also measure 3.25 inches. The wheels of the trailers are shod with steel bandages. On the Balachowsky & Caire gasoline-electric trucks weighing 13,000



Rubber-shod cast steel front and rear wheels of the Balachowsky & Caire gasoline-electric truck

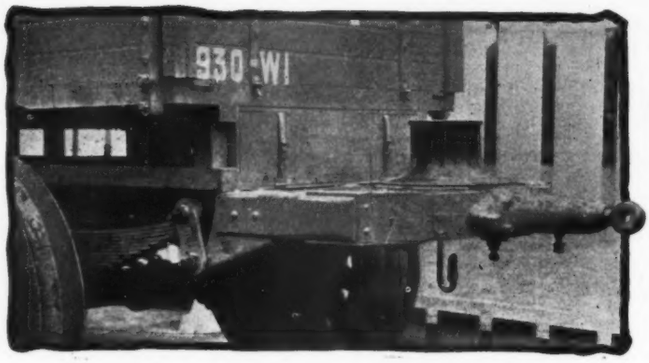
pounds, of which 6,100 pounds is useful load, the rear tire width is 4.5 inches. Although having rubber tires front and rear, these trucks have the entire power plant mounted on a coil-spring suspended subframe. Dietrich, with a useful load of 6,600 pounds and total weight of 14,000 pounds, uses springs with eleven leaves and 3 inches in width. This may be taken as quite standard practice.

The great majority of the wheels are of wood, the number of spokes being fourteen for the rear and twelve for the front. Latil, Balachowsky & Caire and Peugeot are using cast steel wheels and Bayard-Clement is employing steel disk wheels. All the metal wheels are shod with rubber tires. On one of the Latil the combination is steel wheels with rubber in front and wood wheels with steel bandages in the rear. There are indications that the cast steel wheel will become more popular. In the past trials there has been a certain amount of trouble with wood wheels owing to shrinkages as the result of variations in temperature. This year's wood wheels appear to be better built and much more likely to give satisfactory service than any of those used in earlier trials.

In the adjoining table will be found the motor size (bore and stroke in inches) and other leading particulars. By weight empty in these tables is understood the truck with all tanks filled, driver and mechanic aboard, a very big selection of spares and tools and a platform body with tarpaulin top having hoops of sufficient strength for stretchers to be attached to them. The useful load is thus the actual useful load carried. It will be seen that trucks with motors of practically 4 inches bore (accurately 3.9 inches) are carrying useful loads varying from 7,700 pounds to 5,900 pounds.

In addition to carrying these loads every vehicle must be capable of hauling another vehicle of equal weight over a dry macadam surfaced road having a gradient of 6 per cent. All vehicles must be capable of climbing gradients of 12 per cent.

Left, Balachowsky & Caire gasoline-electric. Center, 30 horsepower front-drive Latil. Right, Clement-Bayard tractor



Hauling capstan on rear platform of Saurer

and have motors of sufficient flexibility to travel in convoy formation with and without load. Although the average speed is 9.3 miles an hour, it is forbidden, under any circumstances, to exceed 16 miles an hour.

Gasoline, alcohol and benzol are the three fuels imposed in the competition. They must be used without a change of carbureter and with no other adjustments than can be made on the roadside. A few of the vehicles make use of all three fuels with no changes in the carbureter, merely adjusting the extra air control from the dashboard. This is done by the Renault vehicles, which have a control whereby they can increase the quantities of cold and hot air. In most cases a smaller jet is used with the change from gasoline to benzol; a small washer is put on the carbureter float to weigh it down and a little more hot air is given. For alcohol the same adjustment is maintained, with a still greater increase in the supply of hot air, the cold air being proportionately decreased. In a few cases the compression is increased for benzol by putting in deeper valve caps. This, however, is not general, the majority of the competitors making no change in the amount of compression.

Motors under a bonnet have a numerical advantage over those with under-the-feet location. There are forty-eight of the former and twenty-six of the latter. So far as the army is concerned no preference is shown, the military regulations only calling for a determined body space. Chain drive is in the majority, with shaft and bevel gearing second and worm gearing found on two types only, a Peugeot and a La Buire. For the first time this year 4-speed gearboxes are an obligatory fitting. Clearance must be 13.7 inches. The method of determining this is to pass a block of wood of special shape and dimensions under the chassis. The height of this test block is 13.7 inches, and if this does not clear the vehicle is refused. Other obligatory features are towing hooks front and rear, a powerful sprag, hood for the driver, a permanent recording speedometer, and lockers with spares and supplies. In most cases these lockers are suspended below the overhanging portion of the body and alongide the frame members. On the De Dion Boutons there are two of these lockers, the left-hand

MECHANICAL FEATURES OF TRUCKS ENTERED IN THIS YEAR'S FRENCH ARMY TRIALS

Make	Cylinders	Motor Location	Motor Speed	Carbureter	Cooling	Lubrication	Clutch	Speeds	Drive	Wh'ls	Tires	Tire Sizes	Useful Load, Lbs.	Overall Sizes, Ins.
Delahaye	Block 3.9x6.2	Bonnet	1100	Delahaye	Pump	Gear Pump	Leather Cone	3.7, 6.8 10.5, 17	Chains	Wood	Rubber	36x4.7 40x5.1	7749	230 78
Delahaye	Block 3.5x5.5	Bonnet	1100	Delahaye	Pump	Piston Pump	Leather Cone	4, 7.5 12, 19	Chains	Wood	Rubber	36x4.3 40x4.7	6100	209 74
Delahaye	Block 3.5x5.5	Under Feet	1100	Delahaye	Pump	Gear Pump	Leather Cone	4.4, 8 13, 20	Chains	Wood	Rubber	36x3.9 36x4.3	6600	200 77
Delahaye	Block 3.3x5.1	Bonnet	1200	Delahaye	Pump	Gear Pump	Leather Cone	4.4, 8 13, 20	Chanis	Wood	Rubber	36x3.9 36x4.3	5900	197 85
Panhard-Levassor	Pairs 3.5x5.1	Under Feet	1000	Krebs	Pump	Circulating	Disk	2.4, 5, 7, 16. 6	Chains	Wood	Rubber	40x4.7 40x4.7	7600 "	207 79
Renault	Pairs 4.3x6.2	Bonnet	1200	Renault	Thermo-syphon	Circulating	Leather Cone	2, 4.3, 6, 8.6	Shaft	Wood	Rubber	37x5.5 40x6.2	5600*	164 79
Latil	Block 3.7x5.5	Bonnet	1000	Solex	Thermo-syphon	Pump Constant Level	Leather Cone	.....	To Front Wheels	Wood Front Steel Rear	Rubber Steel	36x3.5	5500	222
Latil	Block 4.3x6.2	Bonnet	1000	Solex	Thermo-syphon	Pump Constant Level	Leather Cone	.....	To Front Wh'ls	Wood Steel Front	Rubber Steel	36x3.9	6100	202
Latil, 4-wheel Drive Tractor	Block 4.3x6.2	Bonnet	1000	Solex	Thermo-syphon	Pump Constant Level	Leather Cone	.....	Four Wh'ls Driv'n	Cast Steel	Rubber	40x4.3 Twin 40x4.3	5555*	212
Balachowsky & Caire	Block 3.9x5.9	Under Feet	1000	Claudel	Pump	Pressure	.....	.....	Elec.	Cast Steel	Rubber	36x4.7 36x4.7	6100	....
De Dion-Bouton	Pairs 3.1x5.5	Under Feet	1400	Zenith	Pump	Pressure	Disk	2.5, 6.3 10, 15	Shaft	Wood	Rubber	36x4.3 36x4.3	5200	206 79
De Dion-Bouton	Pairs 3.9x5.5	Bonnet	1400	Zenith	Pump	Pressure	Plate	2, 4, 12, 18	Shaft	Wood	Rubber	36x4.7 36x4.7	6200	232 78
De Dion-Bouton	Pairs 3.9x5.5	Under Feet	1400	Zenith	Pump	Pressure	Plate	2.4, 6.2 10.5, 16	Shaft	Wood	Rubber	37x5.1 37x5.1	6900	229 79
Rochet Schneider	Pairs 3.7x5.5	Bonnet	1400	Zenith	Thermo-syphon	Pressure	Leather Cone	4.3, 6.8 10.5, 15.5	Chains	Wood	Rubber	36x4.7 40x5.1	6700	236 78
Delaugere Clayette	Pairs 3.9x5.5	Bonnet	1100	D.& C.	Thermo-syphon	Circulating	Leather Cone	3.7, 6.2 9.9, 12.4	Chains	Wood	Rubber	36x4.3 37x5.5	6100	236 78
Delaugere Clayette	Pairs 3.9x5.5	Under Feet	1100	D.& C.	Thermo-syphon	Circulating	Leather Cone	3.7, 6.2 9.9, 12.4	Chains	Wood	Rubber	37x5.1 37x5.1	7800	216 78
Berliet	Block 3.9x5.5	Bonnet	1000	Berliet	Thermo-syphon	Circulating	Disk	.....	Chains	Wood	Rubber	37x5.1 37x5.1	5900	....
Berliet	Block 3.9x5.5	Under Feet	1000	Berliet	Thermo-syphon	Circulating	Disk	.....	Chains	Wood	Rubber	37x5.1 37x5.1	7500	....

The rear wheels of all machines are fitted with twin tires. All motors have 4 cylinders; all machines have 4-speed gearboxes; high-tension ignition is used in all cases.

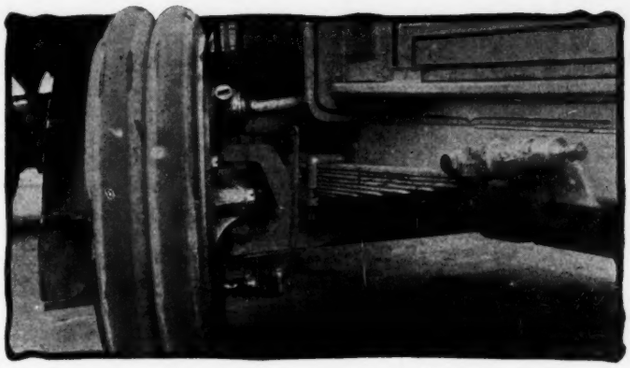
Under heading speed is understood speed of the vehicle on different gears with motor at normal speed.

*These trucks (Renault, Latil, Saurer, Peugeot) also haul one or two trailers.

one being divided into compartments to receive the various parts. On the inside of the swinging lid there is an illustration of all the objects, showing the manner in which they should be packed. The locker on the opposite side serves for spare oil, rags, and the parts most likely to be needed. It is necessary that a very complete supply of spares should be carried, the calculation being made on an actual service basis with the truck altogether out of reach of its factory.

Tractors are a rather important feature of the trials. Machines of this type have been entered by Renault, Peugeot and Saurer. The Renault is an entirely new production with a 30-horsepower motor controlled by a governor to run at 1,200 revolutions maximum. It has a new type of rear axle with differential and reducing gear within an aluminum housing mounted within a cradle formed by a forged rear axle. The differential is fitted with a lock. At the rear of the tractor is a capstan worked by propeller shaft and worm gearing from one of the pinions in the gearbox. The tractor has rubber tires all round the front ones being single and the rear ones twin. There is an elastic coupling between the tractor and the trailer, this latter being mounted on steel tires. The useful load carried on the tractor is 5,700 pounds and on the trailer about 6 tons.

There is only one four-wheel drive tractor in the competition, this being a Latil production with the motor under a bonnet ahead of the front axle, and all four wheels drivers and steerers. It carries a useful load of 2.5 tons and 6 tons useful load on each of the trailers. Twin rubber tires are fitted on the four wheels of the tractor and single rubber bandages on the trailer wheels. The three vehicles forming the train can turn with ease in a roadway measuring 30 feet across.



Coil spring shackle on suspension of front-driven Latil

Only one gasoline-electric vehicle is entered in the competition, this being the Balachowsky & Caire, a new make on the French market. This is operating as a truck, but is at present too recent a production for an estimate to be formed of its capabilities.

Steamers are an unknown quantity. They have never been able to meet the requirement of a non-stop run of 60 miles.

MECHANICAL FEATURES OF TRUCKS ENTERED IN THIS YEAR'S FRENCH ARMY TRIALS

Make	Cylinders	Motor Location	Motor Speed	Carburetor	Cooling	Lubrication	Clutch	Speeds	Drive	Wh'ls	Tires	Tire Sizes	Useful Load, Lbs.	Overall Sizes, Ins.
Berliet	Block 3.9x5.5	Bonnet	1000	Berliet	Thermo-syphon	Circulating	Disk	.....	Chains	Wood	Rubber	37x5.1 39x5.1	6200	....
Berliet	Block 3.5x5.5	Bonnet	1200	Berliet	Thermo-syphon	Circulating	Disk	.....	Shaft	Wood	Rubber	36x4.7 40x4.7	5200	....
Motobloc	Pairs 3.1x5.6	Bonnet	1400	Motobloc	Pump	Pressure	Disk	.....	Chains	Wood	Rubber	36x3.9 36x3.9	4700	224 70
Saurer	Pairs 4.3x5.5	Bonnet	850	Saurer	Pump	Pressure	Disk	3,.7 7.4 11, 15	Shaft	Wood	Rubber	36x4.3 40x4.7	5100	236 67
Saurer	Pairs 4.3x5.5	Bonnet	1000	Saurer	Pump	Pressure	Leather Cone	3, 6 9, 12.2	Chains	Wood	Rubber	36x4.7 39x5.1	6600	237 79
Saurer	Pairs 4.3x5.5	Bonnet	1000	Saurer	Pump	Pressure	Leather Cone	3, 6, 9, 12.2	Chains	Wood	Rubber	36x4.7 40x6.2	6600*	255 82
Brasier	Pairs 3.3x5.5	Under Feet	1400	Brasier	Thermo-syphon	Circulating	Leather Cone	3.2, 11 8, 12.5	Chains	Wood	Rubber	36x4.7 36x4.7	5500	204 82
Brasier	Pairs 3.9x5.9	Under Feet	1350	Brasier	Pump	Circulating	Leather Cone	4, 6, 8, 12	Chains	Wood	Rubber	36x4.7 36x4.7	7500	204 82
La Buire	Pairs 3.5x6.2	Bonnet	1000	Zenith	Pump	Pressure and Troughs	Disk	3.2, 5 8.7, 13	Shaft	Wood	Rubber	40x4.7 40x5.1	7300	182 75
Peugeot	Block 3.5x5.9	Bonnet	1000	Zenith	Pump	Pressure and Troughs	Disk	3, 6.2 10, 15.5	Shaft and Worm	Cast Steel	Rubber	36x3.9 40x4.3	5000	228 75
Peugeot	Block 3.5x5.9	Bonnet	1000	Zenith	Pump	Pressure and Troughs	Disk	3, 6.2 10, 15.5	Shaft	Cast Steel	Rubber	36x4.7 36x4.7	6400	228 75
Peugeot	Block 4.7x5.9	Under Feet	1000	Zenith	Pump	Pressure and Troughs	Disk	.....	Chains	Cast Steel	Rubber	37x5.5 37x5.5	7000*	236 78
Clement Bayard	Pairs 3.5x5.5	Under Feet	1500	Clement Bayard	Thermo-syphon	Circulating	Leather Cone	.....	Chains	Steel Disk	Rubber	36x4.7 40x4.7	6100	196 78
Lorraine Dietrich	Block 3.7x5.6	Under Feet	1000	Dietrich	Thermo-syphon	Circulating	Leather Cone	3.5, 6.2 8.7, 13	Chains	Wood	Rubber	36x4.7 40x4.7	6800	196 78
Aries	Block 2.8x5.5	Bonnet	1300	Claudel	Thermo-syphon	Pressure	Disk	4.3, 6.8 10, 15.5	Chains	Wood	Rubber	36x3.9 36x3.9	4400	224 79
Aries	Block 3.5x5.9	Bonnet	1250	Claudel	Thermo-syphon	Pressure	Disk	3.8, 7.4 9.9, 15.5	Chains	Wood	Rubber	40x4.7 40x4.7	6600	224 79
Aries	Pairs 4x6.2	Under Feet	1000	Claudel	Pump	Pressure	Disk	3.2, 5.6 7.5, 12.5	Chains	Wood	Rubber Steel	37x5.1	8000	225 80
Peugeot	Block 3.5x5.9	Bonnet	1000	Zenith	Pump	Pressure and Troughs	Disk	.....	Chains	.....	Rubber	36x4.7 40x4.7	6600	225 90

The rear wheels of all machines are fitted with twin tires. All motors have 4 cylinders; all machines have 4-speed gearboxes; high-tension ignition is used in all cases.

Under heading speed is understood speed of the vehicle on different gears with motor at normal speed.

*These trucks (Renault, Latil, Saurer, Peugeot) also haul one or two trailers.

The Engineering Digest

High Compression Needed to Burn Benzol Vapor Properly—Kerosene Unfit for Vaporization—Latest Aspirant for Valveless Honors—A Discovery in Steel

CAN Carbureters Handle Different Fuels Satisfactorily? Experts Think Not—In spite of prizes offered for carbureters suitable for preparing explosive mixtures from benzol and kerosene as well as from gasoline, with a view to having automobile motors operated indiscriminately with any one of these fuels, and despite official encouragement in other forms for the same idea, the very extensive consideration which has been given to the fuel question in Europe during the past two years seems to tend toward the formation of an opinion among experts according to which it would be futile to hope for more than a makeshift arrangement if improvement of the carbureter alone is relied upon for enlarging the fuel range.

The whole subject of carbureters and fuels is illustrated and reviewed in a lengthy serial article in *Automobil-Rundschau* by Dr.-Ingenieur Karl Büchner and the experience which was gained with alcohol motors with high compression before the price of alcohol in Germany became prohibitive, is brought to bear on the discussion, so as to show that the best results were obtained only by special motor and carbureter design and that the same should hold true for benzol, as the same reasons exist. Some passages from the last instalment of the article are rendered in substance in the following and make the viewpoint clear.

The inferences [from the experience with industrial alcohol motors] with regard to benzol are very simple. Here, too, it should be a fruitful idea to look upon the carbureter mainly as an atomizing and mixing device while conceiving the cylinder as the vaporizer. The combustion-chamber and the cylinder should, then, be so designed that during the suction stroke a pronounced transmission of heat takes place from their walls to the fuel mixture. The most favorable temperature of these walls must be determined by systematic experiments, and in undertaking these it is well to remember that the accumulations of heat which must be avoided in the cylinder walls with regard to the lubrication may be very useful in the combustion chamber.

The alcohol motors of Deutz and Daimler were long-stroke engines, as compared with the automobile practice of the day when they were designed, having a stroke 1.4 and 1.6 times larger than the bore, and a long stroke should also be recommendable for automobile motors which are to be operated with benzol, as this design assists in the vaporization of the fuel. The compression ratio in the Deutz motor was about 9 and in the Daimler more than 10, while with gasoline the admissible maximum is 5, and with this high compression a thermic efficiency of 32 per cent. was attained. The formation of rust in the cylinders, which constituted one of the objections to the use of alcohol as fuel and is likewise mentioned today as an objection to the use of benzol, was by the same means—the high compression—completely obviated, as the perfect combustion prevented the formation of acetic acid. To obtain the same effect in the case of benzol the removal of all traces of sulphuric acid, remaining from the distillation process, would also have to be looked after, however.

Benzol, by reason of its high carbon and low hydrogen content, can be used with almost exactly the same compression as alcohol and its superiority over gasoline under certain circumstances depends upon this fact. But if no use is made of this advantage, the employment of benzol becomes in the majority of cases only a more or less troublesome makeshift and fails to answer to the highest requirements.

It is almost to be deplored that the compression and the length of stroke which are now customary in the best automobile motors admit the use of benzol as fuel in a fashion and have made it comparatively easy to operate with either fuel in the same motor, as this condition, while not leading to the best results, has made it appear as if the question of using benzol were mainly a carbureter problem and has engendered a certain indifference to a more complete and rational development of a true benzol motor. Yet such a development is indispensable in the long run, as even the most enthusiastic advocates of benzol admit that it is a sluggish fuel for accelerations in the ordinary automobile motor. [The author refers especially to Dr. Dieterich who, however, finds that this fault can be remedied by mixing the benzol with petroleum-ether—naphta—in the proportion of 2 to 1; see THE AUTOMOBILE of July 10, page 63].

Through the tests conducted by Professor Riedler it has been demonstrated [the data, figures and diagrams being reproduced in Dr. Büchner's article] that 300 more heat units are required for developing 1 horsepower-hour from benzol than from gasoline in a motor—a 35-horsepower Büssing truck motor—built for either fuel, and that for this reason the economical advantage of the benzol, due otherwise to its lower price, is almost neutralized. And on the other hand it has been shown by Friedrich Barth that the consumption of heat units is considerably smaller for benzol than for gasoline in the case of stationary motors, when those built for benzol, like those for illuminating gas, have high compression, while those for gasoline have only the maximum admissible with this fuel. The waste of calories is therefore not a necessary feature in operation with benzol but only one depending on design. The high compression which is necessary with benzol, as with alcohol, has the additional advantage of making the motor less sensitive to variations of the proportions of the fuel mixture, as demonstrated by Professor Nägel, and results in a higher mean effective piston pressure and consequently a higher motor efficiency. With the reduced sensitiveness toward variations in the composition of the mixture the problem of carbureter design is at the same time simplified.

[Dr. Büchner sees the future in a development of high compression motors, of the type of the best alcohol motors in which the compression reaches 142 pounds per square inch, with a possible additional equipment for the forcible injection of surplus air to facilitate the atomizing and combustion of a high fuel charge, motors of this class to be operated with benzol or other fuels derived from the distillation of coal, including naphtaline, and he voices in this respect the German desire for a complete emancipation from the various fuels derived from imported crude oil. From an American viewpoint the force of his reasoning might suggest the advisability of designing motors in which a material change in the rate of compression might be effected by adjustment, since, according to the facts cited by him, this feature coupled with a long stroke and suitable provisions for an energetic atomizing of the fuel would result in a motor suitable in almost equal degree for gasoline, benzol and alcohol.—ED.]

A French engineer, A. Grebel, looks to compressed coal gas as a promising fuel under French conditions for motor truck and omnibus traffic and expects to find it used in the future on an equal footing with benzol for these purposes, both these fuels being susceptible of high compression without danger of premature ignition and therefore suitable for use in the same class of motors—and in this respect he shares the views of Dr. Büchner—but for automobile purposes in general he believes that kerosene will be found preferable as soon as motors really suitable for kerosene are produced. From his presentation of the subject in *Le Génie Civil* the following extract relating to the kerosene may be found of interest:

An explosion motor cannot be run with pure kerosene without fouling almost immediately. The exhaust is smoky and ill-smelling. Premature ignition occurs often and the fuel consumption reaches such exaggerated figures that economy goes by the board. Many inventors have sought to use kerosene by providing an intense preheating of the carbureters. Those systems of this class which give the least wretched results have no conduit between the cylinder and the vaporizer; the latter may even, so to say, form a part of the combustion chamber. Whether the gasification of the kerosene is effected in a retort heated by an exterior flame or by the exhaust gas or in a portion of the combustion chamber which always remains hot, great difficulties are always experienced in the matter of regulating the heat according to the speed and the load of the motor. [Nevertheless thousands of open-sea fishing vessels are operated with kerosene motors having the hot-chamber ignition to which the author refers, but the load is constant and the throttling range is very limited. The operation of these motors is not troubled with fouling, but the fuel economy is poor, being acceptable only because the speed of the boats is very moderate, so that small horsepowers suffice.—Ed.] The disintegration or cracking of the kerosene, which is the source of fouling, cannot be completely avoided. Finally the start cannot be effected without previously heating the vaporizing chamber or running for a while on gasoline.

In order to obtain continued and regular operation with kerosene from small motors of high and variable speed it would be absolutely necessary to adopt another cycle than that of the explosion motor. It has already been contemplated, for example, to introduce the kerosene in the cylinder in a very finely pulverized state and to facilitate its evaporation by maintaining a relative vacuum during a portion of the induction stroke. The heat of the cylinder walls coupled with the rarefaction of the atmosphere would complete the vaporization of the kerosene dust. But this and other processes are, it is thought, only palliatives. Kerosene is not a volatile fuel and the great mistake of the experimenters lies in insisting upon vaporizing it in spite of the fact that the boiling point of its heavy constituents lies very close to the temperature at which it is disintegrated. It is a liquid fuel only a little less heavy than distillate or heavy oil of coal, but it should be treated as these substances and not as gasoline or benzol. Granting that it is much more readily ignited and burned than the heaviest petroleum and coal oils, it should be possible to employ it for small high-speed motors with rapid but not explosive combustion in which the cycle should be more or less similar to that of the Diesel motor or perhaps rather that of the Sabathe motor. The need arising in that case for having compressed air for effecting injection, pulverization and ignition, with avoidance of either premature ignition or cracking of the fuel and fouling of the motor, would result incidentally and in a highly acceptable manner in affording means for the inflation of air tires and, more important yet, for starting the motor automatically from the driver's seat, without preheating of any part and without the use of gasoline. [Dr. Büchner, too, marshals facts in support of the contention that kerosene and petroleum fuels generally should be handled on a plan similar to that of the Diesel motor.—Ed.] While the problem of perfecting a small high-speed kerosene motor really suitable for automobile purposes may be difficult it is not insoluble, and while such a motor probably will cost more to build than a gasoline motor, those competitions, on the other hand, which have been arranged for apparatuses designed to render it possible to operate gasoline motors with kerosene, optionally, seem dangerous, in so far as they are likely to steer the development into a blind alley.—From *Automobil-Rundschau*, June 15, and *Le Génie Civil*, June 28.

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GUITTON'S Combination Sleeve-and-Rotary-Valve Motor—In the majority of non-poppet valve motors which have been produced in order to meet a supposed demand certain defects have been noticed. Usually the valve organ is subject to pressure from the gases contained in the cylinder and the pressures result in waste of power and wear of the contacting surfaces, while the forces which are applied in this manner are not always mutually balanced and therefore disturb the equilibrium of the motor. Secondly, the valve ports are in many cases exposed to contact with burning gases, and their edges are thereby worn away rapidly. Tight joints are sometimes obtained with great difficulty and by means which resist prolonged wear poorly. F. Guitton, an engineer who has occupied leading positions with several French manufacturers of note, has now designed a motor in which these drawbacks are thought to have been eliminated. He combines the rotary with the sleeve valve system. Two cylinders have a rotary valve in common and each of them a sleeve valve, as shown in Fig. 1. The rotary valve shaft S turns at half the speed of the motorshaft and the shaft E of the eccentric by which the sleeves are operated also turns at half speed. Fig. 2 shows in plan and elevation the different positions of the valve organs at the different stages of the cycle in the case of a two-cylinder motor. Each of the two cylinders A and A′ communicate by means of a single port CC′ with the valve chamber containing the rotary distributer D (shown separately in Fig. 1). Each of the sleeves FF′ has a port OO′ serving to open port CC′ for intake and exhaust while the sleeve closes it for compression and explosion. The eccentrics operating the reciprocating sleeves are set 90 degrees apart. The distributer valve D has two ports M and N which are located with exact reference to their functions for both cylinders and the speed of rotation of shaft S, and these ports are separated by the partition R which is oblique and curved, so as to make M and N, which are at about the same level, communicate one with the top and the other with the lower opening of the distributer and thereby with exhaust and intake pipes respectively. The ports CC′ each span an arc of 45 degrees on the surface of the distributer valve D and face 90 degrees apart on the cylinders where each of them covers an arc larger than 45 degrees. On the other

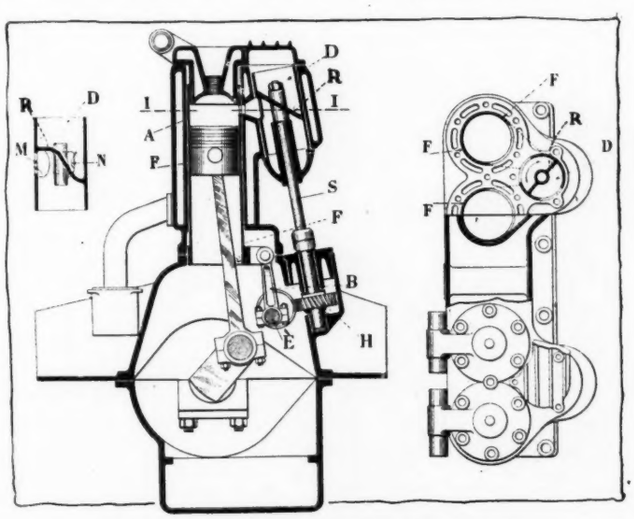

Fig. 1—Latest French non-poppet valve motor

hand the height of these ports on the side in contact with the distributer is increased. Further, the induction port N in the rotary valve is broadened on the side corresponding to the end of the induction stroke, to the effect that the port in the distributer valve is still entirely open when the sleeve closes the induction port in the cylinder.

In the first pair of diagrams in Fig. 2, cylinder A is at the end of the exhaust and beginning the suction stroke while cylinder A′ is at the beginning of exhaust with a suitable advancement of the gas release. In the second pair, A is at the end of induction and beginning of compression; A′ at the end of exhaust. In the third pair of diagrams, A is at explosion and A′ at the end of suction. In the fourth pair, finally, A is at the beginning of exhaust and A′ at explosion. It is noticed that the uncovering of the port for induction is effected by the valve motion alone, the port in the sleeve being at that moment nearly in line with the port in the cylinder, The closing of the induction is effected by the sleeve alone, the distributer port remaining open. The uncovering for the exhaust is brought about by both the sleeve and the rotary valve, but the valve port is a little ahead, so as to avoid gas pressure on the valve body. The closing of the exhaust, finally, is done by the valve alone, considering that the sleeve at this moment is uncovering the cylinder port almost completely.

The advantages claimed for the design are the following: Ports of very large areas can be used. Openings and closings are effected at maximum speeds. The rotary valve is protected against pressures from the compression, the explosion and the expansion and against high temperatures; it is cooled by water circulation and by the fresh gas with which it is always in contact on a large portion of its circumference; it can function practically without friction, absorbing but very little power and this non-intermittently. The fresh gas arrives at the axis of the valve and the centrifugal action upon it facilitates its passage into the cylinders. The inertia of the sleeves is less important than the corresponding factor in motors in which two alternating sleeves are used in each cylinder and also less than where a single sleeve is used without a rotary valve, as in that case the single sleeve has to have a larger motion and a more complicated control.—From *La Vie Automobile*, July 5.

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STEELS of Similar Chemical Composition May Differ Largely in Quality—According to the investigations of N. T. Belaiew which were reported in *Revue de Métallurgie* for September, 1912, the structure of a steel in its large features cannot be modified by ordinary mechanical working or heat treatment. The initial crystalline formation always governs the result. Now Mr. Brès finds that the conclusions reached by Belaiew also hold good for the microstructure and that steels which are almost identical in chemical composition may vary greatly in structure and physical properties, the latter being found by tests to follow the structural peculiarities rather than the chemical composition.

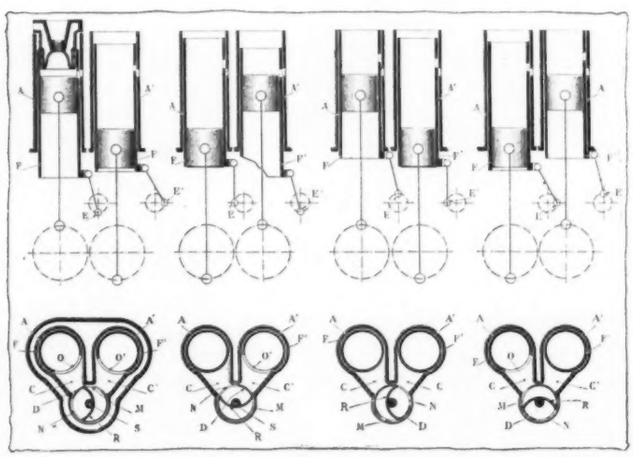

Fig. 2—Movements of sleeves and rotary valve in Guitton's motor

The samples examined by Brès were four medium hard chrome-nickel steels all turned out in ingots weighing 350 kilograms in a small electric furnace. They were found to be free from any trace of tantalum, molybdenum, vanadium, copper or titanium to which unusual effects might have been ascribed. The composition of the samples is given together with the tensile strength and the elastic limit in the accompanying table:

Sample	C	Si	Mn	S	P	Ni	Cr	R	E
A	0.190	0.185	0.440	0.022	0.012	2.53	0.63	58	46.5
B	0.180	0.180	0.430	0.024	0.013	2.67	0.55	74	52.5
C	0.190	0.115	0.530	0.022	0.009	2.69	0.64	100	78.5
D	0.210	0.180	0.605	0.020	0.010	2.71	0.74	76	55

The discrepancies noted under R (ultimate strength) and E (elastic limit) were also represented in the elongation and in various dynamic tests the figures for which are here omitted for brevity's sake.

An examination of the microstructure showed the usual perlitic structure of medium-hard chrome-nickel steels in sample A, but in sample B a special and somewhat granulated fine perlitic structure usually found only in chrome-nickel steels of higher carbon and equal chrome and nickel contents of the kind used for automobile gears. Sample C showed a still more abnormal perlitic structure which is characteristic of steels belonging at the lower boundary between perlitic and martensitic steels and which are used for certain very hard-pointed projectiles. Sample D, though higher in carbon, manganese, nickel and chromium than B and C, presented a structure very similar to that of B alone with which it was also almost identical in properties.

By forging and annealing it was attempted to reduce the samples A, B and C to some kind of similarity, but they retained their peculiarities throughout all changes, so far as the size and distribution of ferrite and perlite crystals were concerned. The structural elements were deformed and divided in the usual manner but, comparatively, the three steels remained as different as before. Under heat-treatment, quenching, tempering and annealing the three samples showed each the properties found in steels of the same structural class. The critical temperatures of A, B and C were found to differ exactly as do those of ordinary chrome-nickel steels of which one is medium-hard, the second one hard and the third one very hard. The three samples of almost identical composition were thus in reality found to be three different steels.

Micro-photographs and a commentary article by A. Portevin accompany the report of M. Brès, which is found in *Revue de Métallurgie* for July.

[The greatest practical significance of the facts noted by Brès seems to lie in the establishment of a probability to the effect that electrically made steels of a given composition are much more likely to vary in their physical properties than other steels of comparable composition because the electric processes can be carried out at great variations of temperatures and because such variations in the temperature at the moment of pouring the metal into the ingot mold and in the duration of the temperatures before pouring as well as in the rate of cooling of the ingot seem to afford the only plausible explanation for the observed differences in structure and properties. It is admitted that variations of similar range and importance are not commonly found in steels made by the open-hearth or crucible methods, in which practice has been developed to such a point of uniformity that the temperatures to which the steel is exposed do not vary many hundreds of degrees, as between one melt and another. At the same time, the new observations suggest the possibility of making steels of very different properties from the same raw materials in the electric furnace, merely through a close control of the temperatures.—ED.]

The Engineers' Forum

Defects in Springs

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Part V

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Was the Element of Friction Between the Spring Leaves Overlooked by Mr. Baillee on His Model?

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THE views of two more engineers on the subject of Defects in Springs are published herewith. The interesting discussion which was occasioned by the appearance of an article regarding spring problems by G. H. Baillee in THE AUTOMOBILE for May 29 has attracted many of our most prominent automobile engineers, shock-absorber men and other authorities on vehicle spring suspension to express their views in The Engineers' Forum. Following is an expression of their opinion as written to THE AUTOMOBILE:

Shock-Absorbers Becoming a Necessity—Gaebelein

NEW YORK CITY.—Editor THE AUTOMOBILE—Mr. Baillee has brought to the attention of the Institute of Automobile Engineers a most interesting subject in his recent paper on Defects in Springs. The models and tests described are indeed most ingenious and actual running conditions are very closely duplicated by this test with possibly one exception. If I understand correctly from the description of the model, the spring was of the full elliptic type with a single leaf above and below. Would this not have the effect of making this spring act as a theoretic ally ideal leaf spring where no friction exists between the leaves? Furthermore, since the element of friction between the leaves of a spring on compression is so important, could not better results have been obtained had a miniature spring of several leaves been rigged on the testing model? This is, however, entirely problematical, as the question of the possibility of construction no doubt prevented the test from being run in this way.

In reference to Mr. Baillee's remarks concerning the use and necessity of shock-absorbers on practically all of the high-grade automobiles, it is very true that such is the case; but the existence and use of shock absorbers cannot well be considered a "grave reflection" on chassis builders.

The automobile industry has adopted, almost universally, the use of leaf springs of various types as a method of suspension between chassis and axle. Let us now consider a semi-elliptic spring subjected to the action of a suddenly applied load or shock, this load having the effect of compressing the spring, and the load being applied downward at each eye of the spring. It may be said that on the compression of the spring by this load, the main leaf of the spring is supported by the auxiliary or supplementary leaves and the following causes give resistance to the load:

1. The friction between the leaves of the spring.
2. The resistance of the spring leaves to flexure.

The spring now recoils and in so doing the load is applied upward at each eye of the spring. The friction between the leaves ceases to exist and the load being propelled upward tends to drag the master or main leaf of the spring away if the recoil is sufficiently excessive, thereby causing possible failure of that member. Is it not true, therefore, that a leaf spring is mechanically incorrect and is capable of taking the load one way only, that is, on compression?

It is very necessary, therefore, that if a shock-absorber is used, its primary object should be to control the spring on reflexion or recoil. In performing this duty, however, it should not affect the compression of the spring, as in doing this the spring is stiffened, its resilience is decreased and the car is made to ride hard.

It is my opinion that the ideal chassis spring is long and resilient, composed of a large number of thin leaves. The main plate, however, should be of a heavy gage of steel in order to give body to the spring, since this member may be said to be the backbone of the spring. A spring designed in this way should give a large displacement when the load is applied and should under its load be quite flat. The displacement should not be so great as to give a very low rate per inch because under operating conditions the spring would strike the frame when an obstruction in the road is met with. Furthermore, this great deflection of the spring would cause such fibre stress in the leaves that the spring would be liable to failure unless built of a very high grade of alloy steel.

It is possible to design springs along these lines and it will be noted that America's easiest-riding cars are so equipped. The practice of using a weak spring assisted by some mechanical device is a mistake. Spring trouble is sure to be the outcome if such methods are resorted to. The entire load of the car with the exception of the unsprung weight must be carried on the springs, and, in order to insure both comfort and spring efficiency, there must be some mechanical means of supporting the spring on its reflex action.

Shock-absorbers are rapidly becoming a necessity rather than a luxury and the automobile engineers of to-day are realizing more and more that an unassisted leaf spring cannot support the reflexion or recoil of a suddenly applied load. A. W. GAEBELEIN, engineer, Clarence N. Peacock & Co.

Hope Mr. Baillee Will Write More—Tuthill

CHICAGO, ILL.—Editor THE AUTOMOBILE—I beg to thank you for the number of THE AUTOMOBILE for May 29th containing an article on Defects in Springs. Our well-known mechanical engineer, Russell Swinton, remarks upon it as follows:

"We find this, indeed, a very interesting analysis of the action of springs under a car, when subjected to some of the very practical conditions of service. Undoubtedly the graphical representation of the relative motion of the body and axle is the most comprehensive and logical way to study the magnitude and action of the forces affecting the different members, and of perhaps arriving at some improvements to procure better riding qualities.

"The treatise represents food for thought for any one interested in spring suspension, and it is only to be regretted that the author did not express more definitely his own conclusions as to some possible ways of overcoming the defects brought out by so careful a study."

I shall be glad to see a further article from the same author. —F. H. TUTHILL, Tuthill Spring Co.

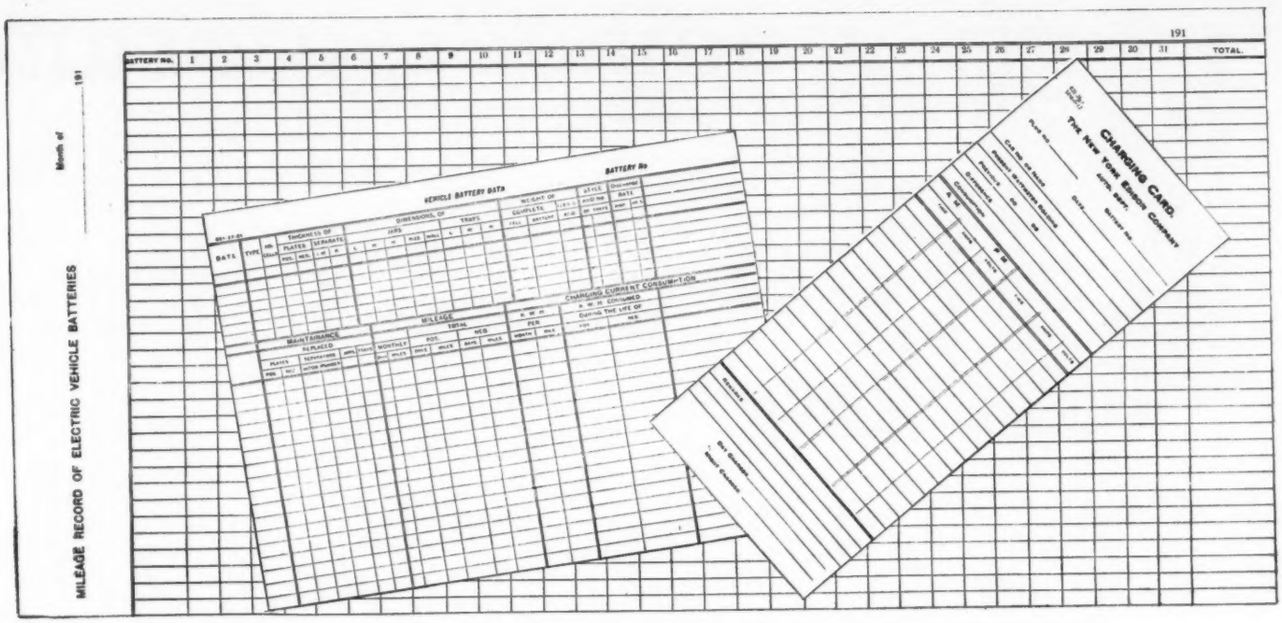


Fig. 1—Batteries working record blank. Fig. 2—History card. Fig.3—Current Consumption record

N. Y. Edison Co.'s Truck System

Three Forms Each Are Used for Battery and Tire Work Records—Full History Kept of Both

Part II

In order to be sure of getting all the service from battery equipment which is expected from it, the number of working days, mileage and current consumption of each battery are carefully made note of

Exact recording is also needed in the case of tires used by the Edison company, and a cross-indexed history system, together with a daily report to headquarters are made to serve this purpose at all its stations.

TOTAL operating cost, which includes that of maintenance, in addition to that of current and lubricants, is made up of repair, battery and tire expenses. The current used by each truck, day by day, is calculated from the records of the man entrusted with the care of the charging switchboard. This equipment, fitted as it is with meters for measuring the quantities of current passing through it, makes the recording of current easy and calls for no more on the part of the man than a notebook and pencil in which the amounts charged into each battery are recorded. These records must of course be typed out later on to assume tangible form. Lubricants and other supplies taken from the stockroom must be recorded there, by means of a requisition system. Battery and tire expenses, however, call for special recording systems of their own.

¶ *Battery Cost Blanks*

Fig. 1, a yellow form 18.5 by 12 inches, serves to keep a record of the vehicles on which the batteries are used from day to day, all through the month. In the first column the number of each battery is entered, the arrangement being numerical; and, as time passes, another column is filled out every day. In this column, and on the same line with the battery number, the number of the vehicle carrying the battery that day is filled in. As the mileage form described in the first instalment of this article gives the daily mileage of all vehicles used, it is easy to figure battery mileages. This is done at the end of each month by a clerk in the superintendent's office.

The next important factor in respect to batteries and their work is the amount of energy which was stored in them during their life. In order to know whether a battery has served as long as it was expected to, one must know the total number of ampere hours for which it served. This information may be obtained most easily by keeping exact records of all charging operations with such details as are provided for on the battery-charging card, Fig. 3. This card is 3.5 by 8.5 inches, printed black on white cardboard and it is filled out by the man in charge of the switch and plug equipment. The wattmeter reading at the time when charging is started is entered on the card, as well as other essential details, and the volt and ammeter readings are taken from hour to hour while charging. The man who attends to the work signs the card when the charging operation has been completed, and the card is turned over to the superintendent.

¶ *Battery History Card*

In order to keep all the essential information relating to a battery together, a card, Fig. 2, has been designed. This card is 8 by 6 inches, printed with black ink on white paper and is divided substantially in two parts: condition report space and work and history record. The condition data are entered upon the upper section of the card. Whenever a battery is inspected the plates are measured, and the same applies to the jars and the trays. Every man familiar with electric vehicles will understand the meaning and importance of each column of this division. The lower section of the card is divided into spaces for maintenance records, mileage records and current consumption records. This section is filled out monthly. On the first or last of each month, the number of days on which the battery

was in actual use and the total miles for which it served during the month are recorded, together with the days and miles got out of the positive and negative plates. The total current consumption for the month and the consumption per mile are recorded. Under maintenance, every replacement of worn-out parts is noted, with the date when the change was made.

¶ *Tire Service Records*

As for tires, these constitute such costly equipment, and the expense, with a large number of vehicles and hard service, is so great, that utmost economy may mean a saving of thousands of dollars every year. When there are fifty-five vehicles in one station, as is the case in Forty-first street, New York City, there are always more than 200 tires in service and the tremendous possibilities for profit or loss in this department are evident without much consideration.

All the tires with which vehicles are equipped are, of course, guaranteed by their respective makers to serve a certain mileage. It is not only necessary to get this mileage out of them, so as to avoid all adjustment expenditures, but most desirable to arrive at a gain in mileage above the guaranteed service. At any rate this is a matter of practical treatment on the part of the drivers; but, whether the latter are good or bad, the very hugeness of the investment involved and the expenses with which this end of the business is fraught necessitate full and exact recording of all data referring to tire cost, service and life.

¶ *Individual Tire Card*

Whenever a tire is bought by the company, a card, Fig. 6, is filled out. The blank here shown is 5.75 by 4 inches and printed in black, being ruled red and blue. The make and size of the tire as well as the type of car it is used on, together with requisition and purchasing order numbers and the date of purchase, are noted on the card. The lower space of the card affords a possibility of entering absolutely all necessary information relating to the tire and its history, from the day when it is installed until it is put out of use. All tires used by the company are numbered in the following manner: When a tire is bought and put in place on a wheel, a brass plate with a number is fixed to the wheel and remains on there until the tire is removed from it. The number accompanies the tire as long as it remains in use. This number is entered upon the card, Fig. 6, in the first space of the top line. The reason for using the brass number plates which are attached to the wheel spokes is that the makers' numbers stamped in the rubber wear off very soon in hard service, and an unerring means of identification is necessary. Also it sometimes happens that a tire is transferred from one wheel and vehicle to another, because the truck it was mounted on originally is put out of commission temporarily or permanently. This method of numbering holds good only for solid tires, not for the pneumatics used on the employees' cars.

¶ *Vehicle's Tire Card*

Practice has brought out the fact that cross-indexing is of advantage in every business where large quantities of different subjects or materials have to be handled or coped with, respectively. It is for this reason that the Edison company not only uses the tire card just described, but also a card, Fig. 5, bearing the number of a vehicle and having space for entering, in the case of each of the four wheels, each tire used subsequently upon it, together with the date of installation. The brass-tag number of the tire is written in the proper space, and the date is entered in small writing above the number. If further information is wanted, reference is had to the individual tire card bearing the number of the tire about which one wishes to be informed.

Finally, there is the necessity of summarizing from time to time the tire situation of the company's station. In order to do this, a daily sheet, 12.75 by 8 inches, is used, which is of thin pink paper and printed in black, Fig. 4. On this form every new tire installation and every replacement of an old tire by a new one are entered, together with the number of the tire as it is received from the maker and the number it receives when installed; and if a tire is discarded or taken off one wheel and mounted on another, the reasons are given, together with dates of installation, demounting, and its mileage.

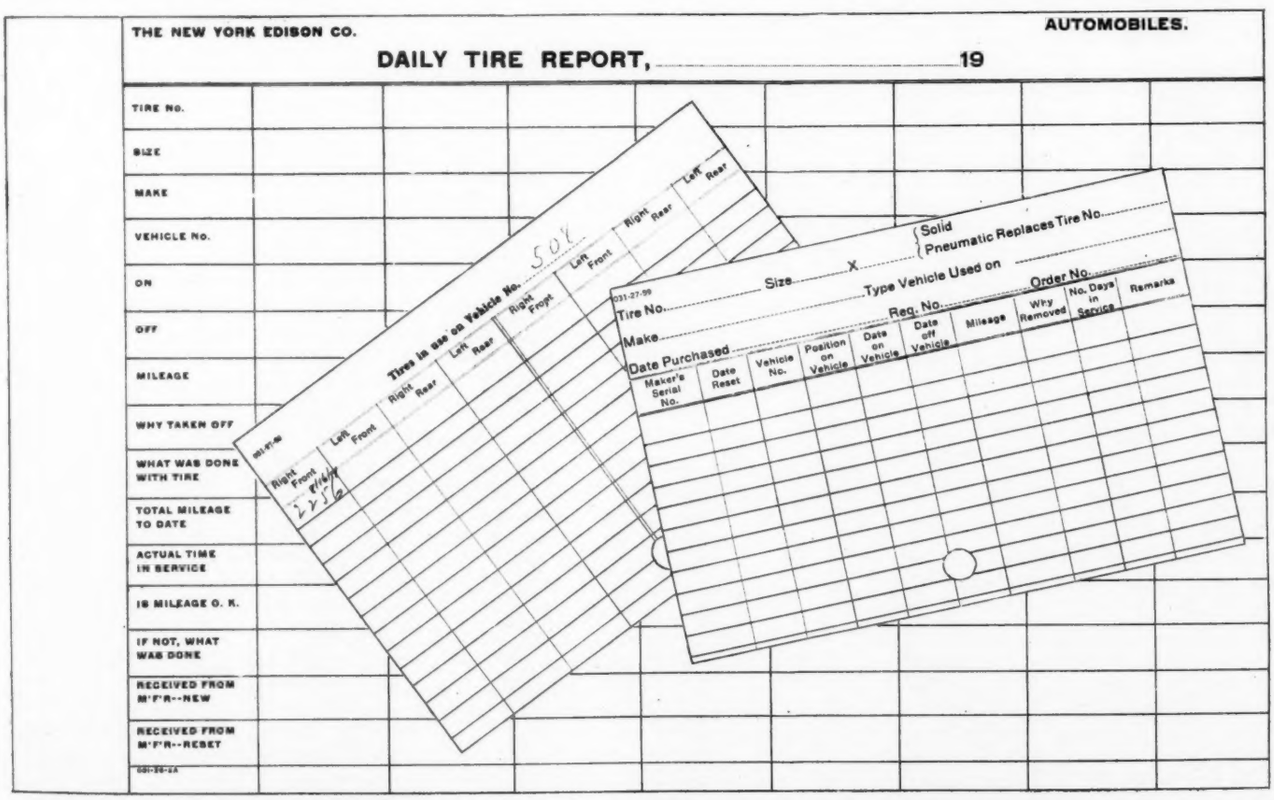


Fig. 4—Daily tire situation report. Fig. 5—Vehicles' tire card. Fig. 6—Tire history record card

Foreign Markets for Commercial Vehicles

French and German War Departments Pay Heavy Premiums to Owners of Home Manufactured Trucks

THE rapidly growing use of motor trucks abroad and the consequent widening of opportunities presented to the American manufacturer who wishes to enter the foreign field render the following extracts from the consular reports which have been recently issued from the Bureau of Foreign and Domestic Commerce at Washington of great interest:

United Kingdom

The use of commercial motor vehicles is gradually becoming more extensive in the United Kingdom, though the increase is not so rapid as in the case of pleasure cars. The total number of pleasure cars registered in the United Kingdom at the end of 1911 was 150,697, and the number of commercial cars 9,195 of which 3,067 were in London alone. At the close of 1912 the latter number had increased to 5,296. The number of horse-drawn commercial vehicles and steam road-locomotives (burning coal) in 1911 was 94 per cent. of the total number of commercial vehicles, and the proportion was lowered to 91 per cent. in 1912.

Commercial motor vehicles are being used for practically all purposes for which horse-drawn vehicles have been employed, but principally by large department stores, manufacturers, storage warehouse men, transportation companies, the post office, etc. A large number of commercial motor cars are now used by the British post office, not only for local business in London, but for interurban deliveries and collections, the number reported as being owned or under order for delivery being 400 to 500.

Practically the whole of the British demand for commercial motor vehicles is supplied by domestic manufacturers, though a number of foreign firms, including American, have introduced their products in this country. There appears to be no sufficient reason why American-made commercial motor vehicles may not compete successfully with those already on the market.

The market in Liverpool for the sale of commercial motor vehicles is reported as a fairly good one, the demand at times being so heavy that the small builders of these vehicles here can not fill the orders. It is predicted that in a year or so there will be practically a boom in types of motor cars not strictly pleasure cars.

There is at present a considerable demand for a delivery van of English manufacture known as the "N" Type Delivery Van. The company making it produces cars of three classes, the "C. O." type, suitable for motor buses; the "C. O. 1" type, suitable for 3-ton motor vans, and the "C. O. 2" type, suitable for 4-ton motor vehicles.

The chassis of these cars are very much alike, that of the 4-ton vehicle being more substantially constructed, and the ratio of its worm gear being modified to suit the heavier load. The engine is of the four-cylinder type, 4.5-inch bore and 5-inch stroke, provided with a reliable system of lubrication. Thermo-syphon cooling is adopted, and ignition is by Bosch high-tension magneto. The makers give the following description:

"The gearbox is of the silent chain-driven type, in which the gears are in constant mesh, and the shafts are mounted on ball bearings; three speeds forward and one reverse are provided. The brakes are applied to the drum on the gearbox shaft and to the inside of drums on the road wheels by pedal and hand lever respectively, and are designed so that all wearing parts are quickly and cheaply renewable. The worm-driven back axle arrangement is of particularly solid construction and trouble proof. The worm is of special steel (case hardened), and the worm wheel is turned from hard phosphor bronze. No load stresses are borne by the driving axles, as the road wheels are arranged to rotate on the ends of the tubular casings enclosing the axles referred to."

The price of the "N" Type Delivery Van chassis, with tires, which are guaranteed for 10,000 miles, is $1,800, and of the bodies for the same range from $195 to $316. The average prices of commercial delivery vans in use in this country, with carrying capacities of 1 1-2 to 6 1-2 tons, are as follows:

Load limit, including body, tons	Horsepower of engine	Chassis prices	Tire prices	Body prices
1½	20	$1,727	$267	$102 to $282
2	22	2,044	340	121 to 321
3	25	2,311	413	136 to 350
4	32	2,579	462	146 to 375
5	36	2,920	559	... ...
6	40	2,993	632	175 to 418
6½	40	3,114	632	... ...

In reply to an inquiry as to whether any trade was to be done here in commercial motor vehicles a member of one of the principal firms replied as follows:

"There is certainly a great business in England for commercial vehicles. I, however, can not say whether any particular manufacturer would have any chance on our market, as I must first know what his selling proposition would be so far as terms of business and trade discounts are concerned. It must be realized that in England it is a difficult job to introduce a new article, and costs a lot of money.

"The great demand for motor transport is being very largely met by a number of the English builders, whose prices are low and who have made good in this country. Still there is plenty of room for others, as the business is practically only opening up, and the manufacturers on this side are small compared with some American concerns; and, furthermore, the English manufacturers are filled up with orders."

The report from Edinburgh states that commercial motor vehicles were introduced into that part of Scotland slowly and with difficulty. The trade had made little progress up to June, 1911, when the number of trucks and wagons of all sizes in that district was 440. In the following 18 months there was an increase of about 50 per cent. At present there are in Edinburgh thirty-one motor trucks, of 2 to 6 tons capacity, and 330 motor wagons and vans, principally light four-wheelers for delivering goods. In the entire district of seven counties, with a total population of 760,000, the heavy trucks number approximately sixty-one and the wagons and vans 570.

The trade automobiles in use are largely of English and Scotch manufacture. They vary in carrying capacity from 5 hundredweight (560 pounds) to 6 tons, and cost complete from $1,000 to $3,000. With rare exceptions they have solid rubber tires. The only restrictions imposed upon traffic are the provisions of the Heavy Motor Car Order (1904) regulating the width of tires of heavy motor cars and trailers having tires which are not pneumatic or of an elastic material. The width of tire required is fixed by a scale varying according to the diameter of wheel and the registered axle-weight. The total axle-weight of a heavy motor car, loaded, is limited to 12 tons, and the weight borne on any axle must not exceed 8 tons. The axle-weight of trailers is restricted to 4 tons. The minimum width of tire permitted is 5 inches for a heavy motor car and 3 inches for a trailer exceeding 1 ton in weight when empty. The speed of a heavy motor car may be from 5 to 12 miles per hour, depending on the weight carried if used with a trailer or if the tires are pneumatic.

The annual licenses on commercial motor

cars are as follows: Weight empty, 1 to 2 tons, $13.85; 2 to 5 tons, $19; not exceeding 1 ton, or exceeding 5 tons, $3.65.

The various departments of the City of Birmingham own and use twenty-eight motor cars which cost with their accessories $58,656 or an average of $2,093 each. The estimated yearly cost of running including wages, uniforms, etc., is $14,133. Including depreciation the total cost is calculated at $32,518 per annum or an average of $1,161 per car. It is calculated that these motor cars average 9,434 miles each and cost 12 cents per car mile. They have displaced seven men, six horses and nine vehicles at an annual saving of $7,619.

France

The exportation of American automobiles to this country has up to the present been largely confined to pleasure cars, and a ready market seems to have been established for light machines selling at a reasonable price.

The French Government pays heavy premiums to purchasers of certain motor trucks in France, with the understanding that they are to revert to the Government for immediate use in case of war. Each year trucks are submitted to the military authorities by the various manufacturers and an exhaustive examination determines whether or not they fulfil all the Government requirements, which are in general as follows: First, the truck must be new, it must be completely constructed in France and of parts manufactured in France, and it must be made in a factory where at least three-fifths of the working force are French; second, it must be used on French territory in some branch of commerce or industry; third, it must conform in construction and equipment with all the requirements laid down by the French military experts. Certain further rules govern the transfer of these trucks after their original purchase.

The payment of the premium is distributed in each case over a period of three years. At the end of each year the car is submitted for Government examination and if it has been well cared for and its equipment is found to be in perfect condition, the annual payment is made. If the condition of the car does not satisfy the examiners, the owner forfeits the balance of his premium. In this way the Government is assured a sufficient number of trucks ready for immediate service in war time. Premiums are allowed only on trucks having a carrying capacity of 2,000 kilos (4,409 pounds) and over. The following table shows the carrying capacity, price and premium allowed on motor trucks made by one of the foremost French manufacturers:

Capacity	Price	Premium
4,409 pounds	$2,412	$965
6,614 pounds	2,798	1,196
7,716 pounds	2,933	1,312

These figures suggest that heavier American cars might have some difficulty in competing with the French product, and as there is no premium on anything below a carrying capacity of 4,409 pounds, the best opening in this country for the present would seem to be in vehicles of that type.

Germany

It was stated in a report sent from this office several years ago that the situation in Germany in respect to motor trucks was not such as to encourage American manufacturers in hoping to enter the German market, and in the interval nothing has occurred to alter this impression.

More than one-half of the 800 and more military motor trucks in Germany belong to brewing companies. On the basis of returns made by fifty-three breweries in answer to questions submitted, it appeared that they had 102 motor trucks and trailers in operation, of which seventy-four were liable to be requisitioned for use in war. The longest distance covered daily was about 65 miles and the shortest 10.9 miles. In twenty-one establishments the range was from 18 to 31 miles; and in twenty-seven, from 31 to 62 miles. The average distance covered by all trucks each day was 42.5 miles.

To profit by these liberal subsidies of the Government the trucks must be manufactured in Germany and must be accepted by the military authorities as complying with the severe specifications which they lay down.

The requirements from the owners of subsidized motor trucks are as follows: (1) The vehicles must not be sold or let to concerns in foreign countries. (2) During a period of 5 years they must be kept in such a state that they can always be turned over for military purposes, and must be ready to be turned over at once, in case of mobilization. (3) Accessories, tools and substitute parts must always be at hand and in good condition so that they can be turned over to the Army Administration together with the motor truck. (4) The Administration is authorized to control the carrying out of these regulations. (5) The vehicles must be insured against fire and accidents, and must be stored in a frost-proof garage. (6) A daily journal must be kept. (7) In the event of war the motor truck must be placed immediately at the disposition of the Army Administration.

Portugal

There seems to be a demand in Portugal for commercial motor vehicles which will probably grow rapidly. At present there are about thirty motor delivery wagons and trucks in use in Lisbon and eleven motor trucks and one motor delivery wagon at Oporto. These trucks weigh 2 to 3.5 tons and are of 20 to 40 horsepower. The limit allowed is 3 metric tons (a metric ton equals 2,204.6 pounds) with load. The delivery wagons weigh from 0.5 ton to 1 ton and are of 18 to 24 horsepower. German manufacturers have supplied the market to a large extent, but French and Italian makes are represented.

Americans would, of course, meet keen competition here on the part of European manufacturers, who have the advantage of short freight haul by rail and frequent direct steamship connections. It is comparatively easy for them to demonstrate a delivery wagon or a light truck.

American motor cars are in good favor with the trade and it is thought that the manufacturer who could once get in here could do a fairly good and safe business.

Austria

The use of motor delivery wagons and trucks is gradually increasing here. The majority of the larger business houses and tradesmen, who formerly used horse wagons, are now using automobile wagons. Two concerns supply almost the entire demand for delivery wagons and trucks in the district of Prague. If, however, the prices of superior American makes could only half-way meet the requirements of this place and the heavy import duty into this country would not be an impediment for the prospective buyer, it is likely that American products could find a market here.

Turkey

At present there seem to be in Constantinople practically no automobile delivery wagons. With the municipal improvements now being effected in the city and the work being done to better the condition of the streets and the roads in and about Constantinople, there should be a good field for all kinds of motor vehicles, and the local representatives of several European firms are already interested in the introduction into this market of such vehicles.

China

Considering the amount of cargo unloaded from steamers at the bund, or landing place, which extends for nearly 2 miles, it might be thought that there would be a good market in Tientsin for motor trucks. The fact is, however, that it is cheaper to move goods by human labor than in any other way, as wages are very low. Freight is carried on the heads and shoulders of coolies or drawn by them on trucks, and they receive 15 to 20 cents (American currency) for a day's work. The large importing firms agree that it would be more costly to handle goods by motor truck than by the present method, although there has been a project, which came to nothing, of organizing a company to run half a dozen motor trucks and motor delivery wagons for the purpose of handling freight for the whole community.

Peru

There are at present probably not more than ten automobile trucks in all Peru, and these are being used as delivery wagons by some of the more important firms in Lima. The reason for this small number is the unsuitable condition of the streets, most of which are very narrow and are paved with cobblestones.

The Rostrum

In which Letters from Readers Are Answered and Discussed

Loose Connecting Rod Bearing Causes Knock—Leaky Motor Hardest to Start—Good Oil Cheapest in Long Run—Steering Worm and Nut—Operating Headlights on Batteries—Heaviest Fuel Is Most Economical Under Certain Conditions

Loose Bearing Causes Knock

EDITOR THE AUTOMOBILE:—I have a four-cylinder 4.75 by 5 motor which has a bad habit of knocking. This knock occurs when slowing down the motor at corners and crossings, and then on opening the throttle the knock develops and lasts until the car has gained headway. Have ground in the valves and removed all carbon. This knock occurs at any position of spark advanced or wholly retared.

2—Where is the Stapley tire pump made?

Pekin, Ill. H. A. RUELING.

—1—This knock is almost sure to be due to a loose connecting-rod bearing. When a motor is running along at a steady speed, the heavy pressure on the connecting-rod bearings is always on the same side. At the wristpin on the down stroke the heavy pressure is on the upper side of the bearing as the explosion pushes down on the piston, but on the suction stroke it changes to the bottom of the bearing as the connecting-rod pulls on the piston. The result of a loose bearing here would be a continuous knock, which would be most apparent at speed changes.

On the lower connecting-rod bearing the heaviest pressure is continuously on one side when the motor is running steadily. On the down explosion stroke the upper side of the bearing presses against the crankshaft and on the up stroke the crankshaft pushes the connecting-rod upwards with the pressure still on the upper side of the bearing. When the speed is changed, however, the crankshaft receives an impulse from one cylinder which jerks it away from the piston on the suction stroke and if there is any loose bearing on the crank a knock will surely result. These knocks are always accentuated at any speed changes and for that reason will occur when slowing down or accelerating.

—2—Bridgeport Brass Co., Bridgeport, Conn.

Harrisburg to Washington, D. C.

Editor THE AUTOMOBILE:—I am contemplating a trip to Washington, D. C., and will thank you to state in the Rostrum columns of THE AUTOMOBILE the shortest and best route from Harrisburg, Pa., to Washington, D. C., with a few words concerning the kind of roads and their condition. Also, whether a license is required to pass through Maryland on a Pennsylvania car.

Herndon, Pa. GEORGE E. ZIEGLER.

—From Harrisburg to Gettysburg the route has been improved during 1912 and is now the best route. The line of travel passes through Dillsburg, Clear Spring, York Springs, Heidlesburg and Gettysburg. From Gettysburg to Washington the road is very fair in dry weather, but poor in wet weather. The route is through Littlestown, Union Mills, Westminster, Cooksville, Olney and Washington.

Local direction, by inquiring the way from town to town will be a sufficient guide in covering the route.

Tight Motor Easier to Start

Editor THE AUTOMOBILE:—The ignition of my car is an ordinary dual type, consisting of battery and high-tension magneto. The wiring seems to be in good condition, and a spark can be traced from either the battery or the magneto right into the spark-plug. The spark-plug, when unscrewed and laid upon the engine, gives a very large, fat spark. The engine will not start, however, and we can get no explosion of any kind. It does not misfire, neither does it back-fire. We would appreciate it very much if you would advise possible sources of trouble. Another man here owns a car exactly like mine. His car has always cranked on the first or second turn of the engine, while mine rarely cranks on less than three to four turns. His car would always idle very slowly, while mine never would. His car would start easily on compression from the push button, while mine never would unless the engine was very hot.

Can you advise what difference or differences in adjustment of wiring or magneto, etc., would cause this difference in starting engine?

Beckley, W. Va. J. H. THATCHER.

—In all probability your motor lacks tightness. Two motors of the same design, bore and stroke will act as differently as if they never had anything in common when the bearing surfaces, valves, etc., vary. In a problem of this nature it is necessary to approach the solution by a process of elimination.

First, try the compression of the motor. Open all the compression cocks but one and pull slowly up on the starting crank against the compression of this cylinder. Considerable resistance should be felt. Hold the crank about half-way up for a few seconds and then pull again, noting if much of the compression has leaked away in the interval. Try all the cylinders in this way, one after another. If you note any that are weak, remove the exhaust valve of that cylinder and examine its seat to see if it is pitted. If you have not ground the valves for the last 3,000 or 4,000 miles they should be ground, anyway. If there are no compression leaks and the valves are in good condition, look for air leaks around the spark-plug and compression cup threads. These can be found by squirting a little oil around these connections and then watching for bubbles while the motor is running.

A point of which you should make absolutely certain is whether or not the motor is actually missing fire while idling. Open the cutout, if your car is equipped with one, while the motor is running idly and listen very carefully for irregularities in the firing. If you have no cutout, it is often difficult to tell, for, although you may get a spark on all the cylinders, with leaky valves the cylinders will be missing while running at slow speeds under no load and with the throttle entirely closed. Often a motor will run regularly on two cylinders while idling and it takes an experienced person to tell whether the motor is "hitting" regularly on all four cylinders or whether it is missing.

If there is any suspicion of the valves it would be well to

have them ground in, because you may find that the trouble is remedied right at that point.

Another feature which should be studied is the width of the spark gaps. It takes less effort for the electric current to jump the gap between the electrodes when the plugs are in the atmosphere than it does when the plugs are in the cylinders under compression. In the latter case the resistance against the spark is much greater and hence the gap might be all right when the plug is laid on the cylinder and might at the same time be too wide when the plug is within the cylinder. The gaps should be examined and if they are wider apart than the thickness of a stiff business card they should be closed up.

Easy starting often depends upon the carbureter. Sometimes the float level in a carbureter will be all right for steady running but will be too low for easy starting. When this is the case there is considerable effort necessary for the motor to pull the gasoline up past the nozzle and get it into the cylinder. The correct level for the gasoline on the average float feed carbureter is about 1/64 inch below the level of the jet nozzle. Many carbureters carry the gasoline level as far below the nozzle as 1/16 inch and hence when starting the motor it is necessary to induce considerable vacuum to pull the gasoline up through the manifold and into the cylinder for the firing stroke. This involves some effort, and although the car will run very well after it has once been started there is often considerable trouble required to get the engine to take hold and act as its own fuel pump. The cure for this trouble will vary, of course, with the carbureter. There is always some ready means, however, to vary the float level. It should be carefully done, as there is a good chance of making too great a change and of having much trouble by reason of flooding.

Regarding the wiring and ignition of the car, if you have traced the spark right down to the cylinder and found that everything is as it should be in that respect, you can do nothing that will help the motor to start easier in so far as the ignition is concerned. As long as a good spark is produced in the cylinder all that remains for easy starting is to get a rich mixture into the cylinder. With these two factors present an explosion is just as certain as if you touched a match to gunpowder. The electric spark will light the gasoline vapor.

One point that it would be well to look for on the carbureter is the seating of the auxiliary air valve. If it has a tendency to be off its seat you will get too much air in your mixture at the slow speed of starting and it will cause a delay in getting the motor to take hold and explode. Most of the new cars have an air shutter, by means of which it is possible to cut off the supply of air while cranking the motor and this forces all the suction to fall on the jet. If you have no such attachment, look at the auxiliary air valve and see that it is firmly seated; if not, turn it up until it does.

As far as starting on the spark is concerned, that is merely a matter of holding a rich mixture in the cylinder. When throwing off the ignition in stopping the car, open the throttle wide, and while the motor is still spinning under its own momentum it will draw in a rich charge. When the button is pushed you should secure an explosion. If you do not it is a good sign that the compression in the motor leaks, and if you have failed by this time to find the seat of the trouble you should have the motor looked over for poor rings, etc.

Why Good Oil Is Cheapest

Editor THE AUTOMOBILE:—There is a strong tendency at the present time toward the purchase of "motor oils," so called, because they are cheap. In many instances these oils are not intended by the refiner for automobile use at all. This is an unfortunate condition for the car manufacturer as well as the car owner. The best automobile oil has a sufficiently high fire test to stand extreme heat, is filtered through bone charcoal to remove the free or floating carbon, to prevent carbonizing, and if the oil has a paraffin base, the paraffin, which is not a lubricant, is also removed. The cheaper low-priced oil has a low fire test, a low viscosity and is not filtered at all. Result—more oil used, lots of smoke and carbon, carbon everywhere. The spark plugs become fouled, the engine misses, the carbon crusts get red hot, causing pre-ignition, the valves cannot seat flush, causing loss of compression, and the car manufacturer blamed for turning out a bad job. Now the car owner and none else is responsible for this condition. If he will buy a leading brand of oil that has stood the test of time and made good, he will get results that are just the reverse, and will feel more friendly toward his car and the man who made it.

Havoline Oil Co., New York City. OSCAR A. TEMPLETON.

Two Headlights on Dry Batteries

Editor THE AUTOMOBILE:—I wish to install electric headlights to operate on dry cells on a small car used for emergency calls. How many cells should be used and how should they be connected to get the best results? The lights are 6 volts, 12 candlepower.

Lyle, Minn. O. G. T.

—In order to get any service from dry batteries you should not use less than twelve cells. When new the cells will test 1.5 volts each, and by using large wire and making excellent connections you will be able to connect them in three sets of four batteries each, as shown in Fig. 1 at A. When the batteries are connected this way they will give an output of 6 volts for considerable time, the exact length of which will, of course, depend on how long the lights are kept lit.

After some use the voltage of the batteries will begin to drop, and then they can be connected up as shown at B, Fig. 1.

When batteries are connected up with the zinc of one connected with the carbon of the next, they are connected in what is called series. The effect of connecting batteries in this wav is to add the voltage. If two cells are connected, each having

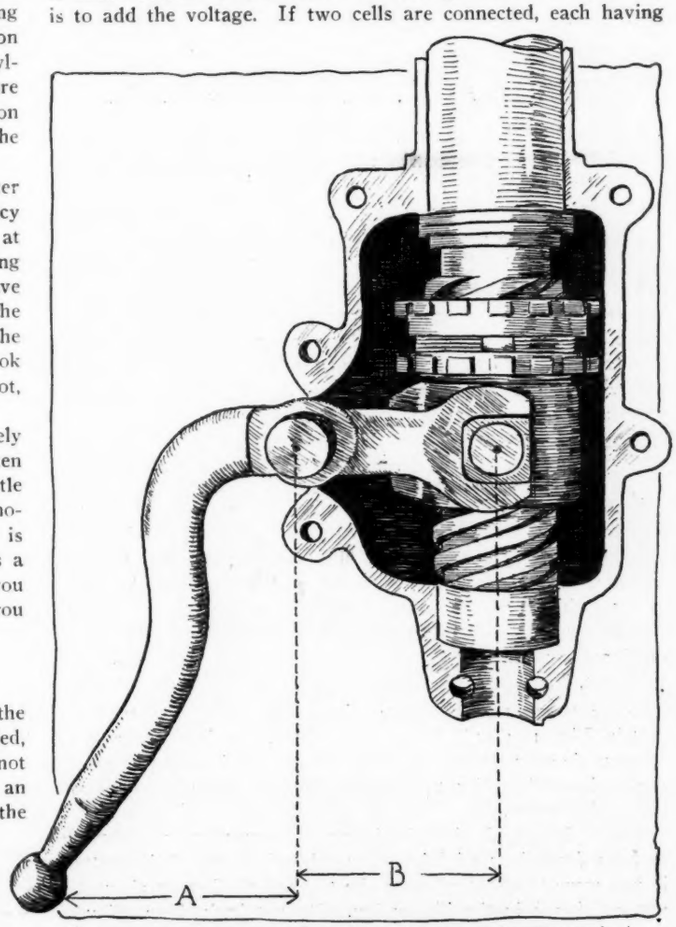


Fig. 1—Interior view of the Clement-Bayard steering gear

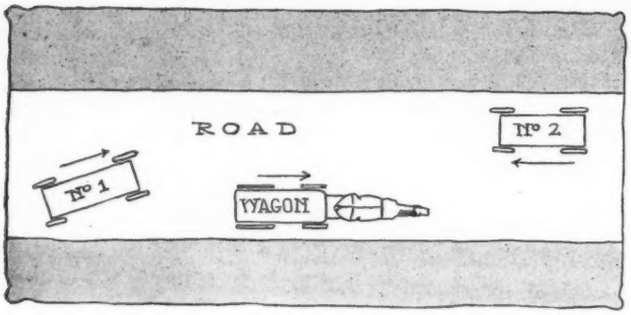


Fig. 2—Car Number 2 has the right of way over Number 1

1.5 volts, the resulting voltage will be three when they are connected in series. When they are connected in parallel, that is, the carbon to carbon and zinc to zinc, the result is that the voltage will remain the same but the amperage will be added.

The lamps themselves should be connected in parallel. This renders them independent of one another. When lamps are connected in series, if one burns out, the other is immediately extinguished also. A diagram showing how the lights on your car should be connected up is given in Fig. 2. This is a parallel connection, and no matter if one light burns out the other will remain lit and there will be no damage done because the voltage drop in the line will be the same.

In making all the connections for the lighting system, the joints in the wire should be well made and then taped, because should a short circuit in the wires occur, it would not take a very long time to run the batteries down to zero.

In wiring up the system use wire all the way through and do not ground the circuit, as you are apt to get into difficulties with your ignition circuit unless you are an adept at electric wiring.

From Cleveland, O., to Meadville, Pa.

Editor THE AUTOMOBILE:—Will you kindly publish in your next issue the best route from Cleveland, O., to Meadville, Pa., or Conneaut Lake, Pa.?

Cleveland, O. F. SAMPOL.

—The best way to make this run is via Youngstown, O. The route you should follow is clear and lies through the following towns: Chagrin Falls, Auburn Center, Parkman, Southington, Warren, Hubbard, Sharon, Mercer, Greenville, Hartsville, Conneaut Lake to Meadville. Local direction will suffice to carry you from town to town. The route is best shown, however, in *The Automobile Blue Book*, Volume 3. You can secure this from any large supply store in Cleveland.

Worm and Nut Not Hard to Steer

Editor THE AUTOMOBILE:—The writer drives a foreign make of car with a steering mechanism using a worm, as shown in the sketch. It is unusually hard to steer, and the writer wishes to know why the steering is much harder than on American cars which use a quadrant. Will you kindly advise whether this particular type of steering works harder than the type used on American cars?

Easton, Pa. H. RINEK.

—The worm and nut type of steering gear shown in the sketch, Fig. 1, should be easy to steer. It is practically an irreversible gear and as such should have a reduction that would render it much easier to operate than the reversible or semi-irreversible types.

The probability is that the joints or connections are binding, perhaps from lack of lubrication. It might also help matters if you were to slightly loosen the toothed pinch nuts above the nut, as shown in the illustration. Do not back these off very much, however.

The leverage in the steering arm as compared by the radii A and B also appear as if the length of the arm B could be slightly longer in proportion to A.

What Is Most Economical Fuel?

Editor THE AUTOMOBILE:—Would you please answer these questions in the Rostrum?

1. What specific gravity of gasoline is most economical (considering mileage, starting, engine trouble, etc.) for automobiles in general?

2. For 1912 Cadillac?

3. What specific gravity is most economical considering mileage only?

4. What would be the difference between motor spirits and a mixture of gasoline (of 70 specific gravity) and enough coal oil to make the specific gravity of the mixture the same as of motor spirits?

(a) In composition?

(b) In power obtained?

(c) In cost per mile?

5. Under the laws of Indiana, which automobile in illustration, Fig. 2, has the right of way when No. 1 has given the signal for the wagon to let him pass, No. 1 and No. 2 being equidistant from the wagon?

Frankfort, Ind. FRANK ANDERSON.

—In general, the most economical fuel is the heaviest that can be successfully carburetted. This, of course, refers to the fuels with a petroleum base. As far as carbon trouble is concerned, if the fuel is successfully carbureted there will be none. With extremely heavy fuels, or even with the higher grades, better economy can be secured by water injection and at the same time carbon troubles will be lessened, due to the action of steam on heated carbon. When steam is passed over glowing carbon it combines with it in the following manner:

$$C + 2H_2O = 4H + CO_2$$

This means that steam added to hot carbon gives hydrogen and carbon dioxide. It is, therefore, a matter of developing a thorough system of carburetion and by using water injection applications, short manifolds, hot-water jackets around intake manifold and carbureter and a good carbureter for reducing the fuel to a mist instead of shooting it out in globular form a heavy and hence more powerful fuel can be used. As far as starting is concerned, that hardly enters the economy, as a pint of high-test gasoline kept in a gas-tight can will be sufficient for all the starts necessary in a month.

2—With a 1912 Cadillac car, using the same carbureter and standard equipment all through and considering the difficulties of purchasing other than standard fuels, the best economy would

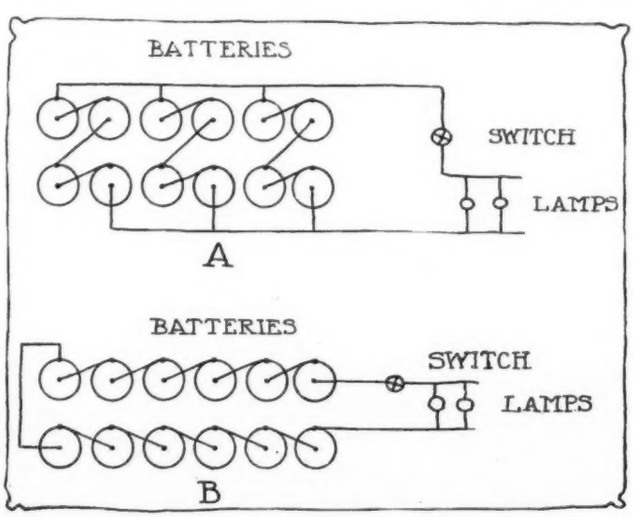


Fig. 3—Connecting batteries to conserve their power

be secured by using Motor Spirit or 60 to 65 Beaumé gasoline.

3—As heavy as you can successfully carburete. If you could carburete crude it would be the most economical.

4—Mixed fuels are not a success for the reason that the more volatile constituents enter the cylinder in the form of gas and the heavier parts go into the cylinder in the form of globules. The result is that an irregular and non-homogeneous mixture goes into the cylinder and a carbon deposit results. The Motor Spirits would give by far the better results.

5—The man on his own side of the road always has the right of way. If you wished to pass the wagon you must wait until nobody is coming in the opposite direction unless the road is wide enough for three abreast. If there were a collision the man on the wrong side of the road would be held responsible.

Gum Camphor with Gasoline

Editor THE AUTOMOBILE:—Will you kindly tell me the virtue, if any, of adding camphor gum to gasoline? The points I have heard in its favor are that from 3 to 5 miles are added to each gallon of gas consumed, and that the explosions in the cylinders have more kick, making a livelier motor. What effect, if any, would camphor have in forming or hindering carbonization?

Methuen, Mass. DR. R. V. BAKETEL.

—The addition of gum camphor to gasoline renders it more volatile and increases the strength of the explosions. As the camphor is soluble in gasoline there will be no difference in carburetion when using it in the motor. It is generally stated, however, that the camphor has a deleterious effect on the cylinder metal. The Rostrum has no definite record of any official tests of the camphor nor of the chemical reactions taking place between the camphor and the iron of the cylinder. The chemical formula, $C_{10}H_{16}O$, for camphor, show that the materials for the formation of ferric, or even ferrous, oxide are present, but whether such a reaction takes place and results in the decomposition of the cylinder wall or not, The Rostrum cannot state. If any readers have definite information on this they would aid in a matter of general interest if they would tell the Editor about it.

Fischer Motor in 1914 Cars

Editor THE AUTOMOBILE:—Can you give me any information about the Fischer vertical slide valve motor and whether any of the American 1914 touring cars will be equipped with this type of motor? If so, please inform me what make. Mr. Howard Coffin's idea of air at the end of the suction stroke right over the top of the piston can be very easily accomplished with this type of motor.

New Philadelphia, O. E. H. URFER.

—As yet no public announcement has been made of any manufacturer of cars who intends to use the Fischer motor during the coming season.

Motor Overheats in Traffic

Editor THE AUTOMOBILE:—1—I am driving a Ford model T car that has the following trouble:

When driving in traffic, the radiator will commence to boil so violently that it forces the water out through the overflow pipe. When I remove the cap a cloud of steam will issue from the radiator and it takes considerable time for it to cool down again. In running on level ground and even up hills at a fair rate of speed I am not troubled at all by the overheating.

2—About how many miles should I be able to travel on a back shoe?

3—How long does it take the average private driver to change a plain clincher 30 by 3 inch tire? It takes me 20 minutes, and I would like to know if I am faster or slower than the average.

4—What advantage is gained by a three-point body suspension?

New York City. FORD.

1—The overheating of the motor under the condition you name is not serious and is common to many otherwise perfect cars of both small and large dimensions. The best you can do is to flush out the radiator well with a solution of common washing soda and water. Put two heaping handfuls of soda to a pail of boiling water and rinse out the radiator. If you have not done this in some time repeat the operation two or three times and finally clan out all the remaining soda with some pure water.

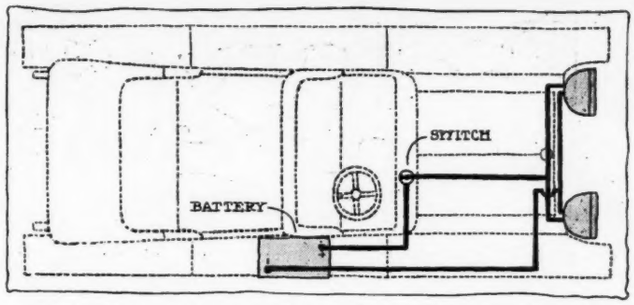


Fig. 4—Diagram of parallel headlight connection with batteries

2—It all depends on how fast you drive the car and what kind of roads you are traveling over. If you run on good roads and do not travel over 20 to 25 miles an hour you should be able to get 6,000 or better out of any of the standard non-skid treads that are built up on the regular tread. On the plain tread tires you should do better than 5,000 miles.

3—About 20 minutes is the average time.

Current Consumption of Lamps

Editor THE AUTOMOBILE:—I am designing an electric lighting system for my car and would like to know what capacity battery I am likely to require in order that I will not be bothered by the continual necessity of restoring the current. I would like to know the consumption of the standard Edison lights to be used for side and tail as well as for headlight purposes.

It would help me also to know what is the amperage of the lamps used for head, side and tail purposes.

Tarrytown, N. Y. SUBSCRIBER.

—The following table gives the data you require for the design of your lighting system. You will notice that the voltages in every case even for the dash and tail lights is given as 6. The voltage of 3 for the tail light is used when it is connected in series with the dash light. If this is done the dash light acts as a check on the tail light and goes out when the tail light burns out. In this way the driver can always know whether or not the tail light is lit.

Voltage	Battery Capacity	Hours Lamps will Burn Continuously	Lamps	Amperes Drawn
6	80	46	Side and tail	1.68
		11	Head and tail	7.42
		9	All lamps	8.68
6	100	58	Side and tail	
		14	Head and tail	
		11	All lamps	
6	120	75	Side and tail	
		17.5	Head and tail	
		14	All lamps	

Temperature Within Cylinder Walls

Editor THE AUTOMOBILE:—Is it possible to obtain graphically a continuous diagram representing the temperature in the cylinder of an internal combustion engine at all parts of the stroke?

Columbia, Mo. C. E. B.

—It is possible to obtain approximate temperatures by computation, but measured temperatures are impossible on account of the smallness of the time factor. Dugald Clerk of the Royal Automobile Club, London, England, has published considerable information on this subject as a result of his research work. It must be remembered that the specific heat of the gases varies so much with the temperature that an accurate knowledge of the amount of heat present at any time during the stroke is more of an affair to be guessed at than anything else.

EFFICIENCY in Goodyear Plant—A splendid example of service and efficiency is to be found in the new Long Island City branch of the Goodyear Tire and Rubber Co., Akron, O., to be completed in about six weeks. This branch will be located at the corner of Jackson avenue and Honeywell street. It is to be four stories high, 275 feet long and 50 feet wide. There is to be a showroom, warehouse, and also a wheel shop, where tire applying and wheel work can be done at all hours. The warehouse will be large enough to carry all the tires necessary to keep this territory supplied.

Buick Plant at Fort Scott—The Buick Motor Co., Flint, Mich., is planning to build an automobile factory at Fort Scott, Kan.

Fire in Metz Plant—The Metz Automobile Co., Waltham, Mass., recently suffered loss by fire to the amount of $500, caused by spontaneous combustion.

Edwards Plant for Canton—A proposition to bring the plant of the Edwards Motor Car Company, New York City, to Canton, Ohio, has been put up to the board of trade.

Canada Gets American Concern—Canada is to get another big American industry, the B. F. Sturtevant Co., controlled by Governor Foss, having purchased the factory of the Canadian Motor Co., in Galt, Ont.

Cole Submits Plans—The Cole Motor Car Company, Indianapolis, Ind., has submitted plans for a new factory building, for which it recently let contracts. It will be of concrete construction, and will be 100 by 383.5 ft. in size.

Old Sellers Factory Sold—The Rexroad Engineering Company, Hutchinson, Kan., has purchased the Old Sellers Motor Car factory, and is planning to reopen and operate it. In connection it expects to do a big business in automobile repair work.

Explosion Wrecks Plant—A large gasoline tank exploded from some unknown cause in the plant of the Delaware Auto Radiator & Lamp Repair Company, Wilmington, Del., recently, badly burning an employe. Buildings in the vicinity were shaken to their foundations.

Smith Moves—The necessity for more space for its frames and other pressed steel parts, has made it advisable for the A. O. Smith Company, Milwaukee, Wis., to transfer the manufacture of the Smith multiple disc clutch to the Universal Machinery Company, Milwaukee.

Will Build $50,000 Factory—E. A. Torrence, of the Torrence Investment Company, P. H. Witschge and W. P. Edris, Spokane, Wash., recently organized a company to engage in the automobile manufacturing business. A factory, costing $50,000, will be built at Sinto and Cedar streets, Spokane.

Maxwell Plant Addition—The present plant of the Maxwell Motor Car Co., at Highland Park, Detroit, Mich., is to be greatly enlarged. Preparations are now under way, but no definite plans have been drawn. If the proposed additions are actually carried out it would enable the company to double its output from the factory.

Automobile Factory for Butler—It is unofficially announced that the new mill being erected by the Standard Steel Car Company, Butler, Pa., is for the manufacture of automobiles to be known as the Standard. The new factory is to cost $2,000,000 and will occupy several acres. The foundations are already being constructed.

Firestone to Enlarge—Fifty tons of finished tires, representing the daily output of the Firestone Tire & Rubber Co., Akron, O., have been found insufficient to supply the demand for this product, so the erectors prepared to increase the manufacturing facilities by the erection of new additions. Work is now progressing on the new structures with every assurance that they will be ready by the fall, at which time they will be doubled. The Firestone company only recently took possession of a new addition, but scarcely had the machinery been installed and the wheels put in operation than it was certain that still more manufacturing space was needed.

Open Rebuilding Plant—A new concern in the automobile field is the Commercial Auto Body & Mfg. Co., Cleveland, O. This company was incorporated early in June with a capital of $50,000, and has just finished equipping its plant in the building formerly occupied by the American Railway Signal Co. This plant is probably the largest and best arranged one of its kind in the city. Truck and other specially designed bodies for commercial uses will be an important part of the company's work, although painting, top and upholstering, blacksmithing and motor repair departments will be maintained. The plant is in charge of J. J. McElligott, superintendent, and N. P. Larsen, manager, who have had extensive experience in leading body plants in this and other cities.

The Automobile Calendar

Shows, Conventions, Etc.

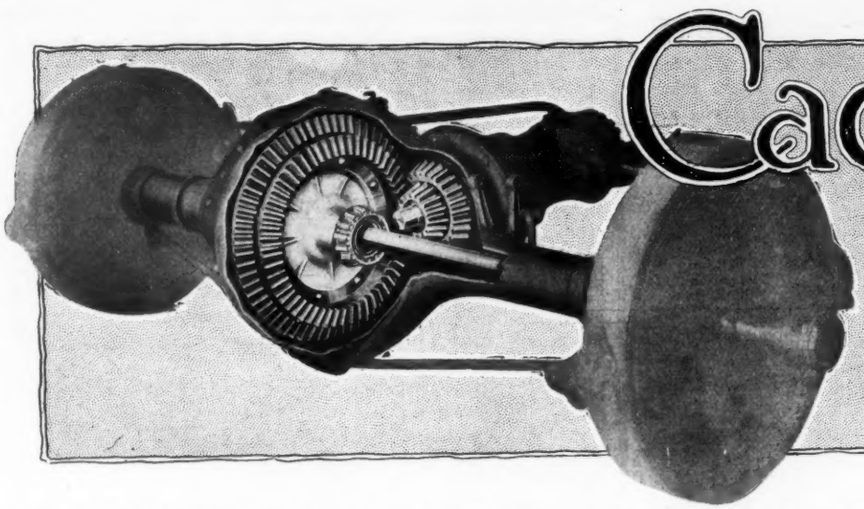
October 13.....Philadelphia, Pa., National Fire Prevention Conference, Philadelphia Fire Prevention Commission.
Oct. 27-28.....Chicago, Ill., Convention of Electric Vehicle Association of America.
December 9-12.....Philadelphia, Pa., Annual Convention of American Road Builders' Association.
Dec. 11-20.....New York City, First International Exposition of Safety and Sanitation, under the auspices of the American Museum of Safety.

Race Meets, Runs, Hill Climbs, Etc.

July 21-25.....Grand Rapids, Mich., Automobile Club Tour.
July 26.....Orangeburg, N. Y., Track Meeting, Rockland County Fair Assn.
July 26-31.....San Antonio, Tex., Tour, San Antonio Automobile Club.
July 27-28.....Tacoma, Wash., Tacoma Road Races.
July 28-29-30.....Galveston, Tex., Beach Races, Galveston Automobile Club.
July 29-31.....Lincoln, Neb., Reliability Run, Lincoln Automobile Club.
July 31.....Philadelphia, Penn., Truck Parade, *Philadelphia Inquirer*.
August .....Des Moines, Iowa, Reliability Run, Iowa State Automobile Assn.
Aug. 5.....Kansas City, Mo., Sociability and Endurance Run from Kansas City to Colorado Springs, Col., Kansas State Automobile Assn.
Aug. 3.....Wichita Falls, Tex., Track Race.
Aug. 7.....Amarillo, Tex., Track Race.
Aug. 9.....Brighton Beach, N. Y., Track Race, Motor Dealers' Contest Association.
Aug. 9.....Santa Monica, Cal., Road Race, Santa Monica Road Race Committee.
Aug. 10.....Pueblo, Tex., Track Race.
Aug. 12.....Kansas City, Mo., Reliability Tour, Kansas State Automobile Assn.
Aug. 15-16.....Denver, Colo., Track Race.
Aug. 18-20.....Milwaukee, Wis., Fourth Annual Wisconsin Reliability Tour, under the auspices of the Wisconsin State Automobile Assn.
Aug. 25-28.....Houston, Tex., Reliability Run, Houston Auto Club.
Aug. 25-30.....Cleveland, O., Midsummer Show, Forest City Fair, Cleveland Automobile Show Co.
Aug. 29-30.....Elgin, Ill., Elgin Road Races, Elgin Road Race Assn.
Aug. 30-Sept. 6....Chicago, Ill., Reliability Run, Chicago Motor Club.
September .....Grand Rapids, Mich., Tour, Grand Rapids Auto Club.
Sept. 1.....Columbus, O., 200-Mile Track Race, Columbus Automobile Club.
Sept. 8-13.....Chicago, Ill., Around Lake Michigan Run, Chicago Motor Co.
Sept. 9.....Corona, Cal., Track Race, Corona Automobile Assn.
Sept. 12.....Canfield, O., Track Meeting, Canfield Fair Assn.
Sept. 13.....Covington, Ky., Track Meeting, Cincinnati Automobile Club.
Sept. 13.....Grand Rapids, Mich., Track Races, Grand Rapids Automobile Club.
Sept. 20-21.....Detroit, Mich., Track Races, Michigan State Fair.
Nov. 4-5.....El Paso, Tex., Road Race to Phoenix, Ariz.
Nov. 4-5.....Los Angeles, Cal., Road Race to Phoenix, Ariz.
Nov. 4-5.....San Diego, Cal., Road Race to Phoenix, Ariz.
Nov. 6.....Phoenix, Ariz., Track Meeting, State Fair.
Nov. 24.....Savannah, Ga., Vanderbilt Cup Race, Motor Cups Holding Company.
Nov. 27.....Savannah, Ga., Grand Prize Race, Automobile Club of America.

Foreign.

July 15-30.....London, Eng., Olympia Heavy Motor Vehicle Show.
July 18-26.....London, Eng., Imperial Motor Transport Conference.
Aug. 28-30.....Ghent, Belgium, Institute of Metals, Annual Autumn Meeting, Ghent International Exhibition.
Sept. 21.....Boulogne, France, 3-Litre Race.
Sept. 25.....Isle of Man, International Stock Car Race.
October 17-28.....Paris, France, Automobile Show, Grand Palais, 10 days.
November .....London, Eng., Annual Automobile Exhibition, Olympia.



Cadillac 1914 CARS Have Two-Speed Rear Axle

CADILLAC motor cars for the 1914 season will continue to be built on a single model of chassis with a four-cylinder motor. However, they are bristling with new features, some of them quite radically different from anything heretofore brought out by the Cadillac company. Refinements of little details add comfort for the passengers and make it all the easier to operate the cars.

The most radical of the new features of these new Cadillacs is the adoption of a two-speed, direct-drive axle to replace the conventional single type. Although such an idea of affording two different gear ratios in the final drive member has already appeared on one high-priced car, the Cadillac company is the first of the medium-price manufacturers to take it up.

However, the Cadillac scheme differs materially from that of the other make referred to in the manner of design and method of working out of the mechanical details. Instead of having a single-bevel-driving pinion connected with the propeller shaft and a single-bevel-driven gear as in the ordinary construction, the Cadillacs are to be fitted with two bevel pinions and two bevel gears. This affords two different gear ratios, each driving direct from the engine to the axle without intermediate gearing. The low gearing gives a ratio of 3.66 to 1, while the high is 2.5 to 1.

Interlocking Devices Employed

Clutches engage either set of gears individually, suitable interlocking devices preventing the engagement of one set while the other set is still operating. The changing from one set to the other is a very simple matter, and one which is noiseless. A small switch located on the right front door of the body and within convenient reach of the driver does the selecting of the gear combination, while the actual shifting is done by simply pressing in the clutch pedal. Throwing the switch one way magnetically draws the corresponding latch into position, and the pressure on the clutch pedal pulls its set of gears into action, at the same time releasing the other set.

The representative of THE AUTOMOBILE was given a demonstration of this new feature. The only perceptible change which the shifting to the 2.5 to 1 ratio made was in the slowing down of the speed of the motor for the same car speed as that maintained with the 3.66 to 1 ratio. There was absolutely no noise connected with the changing of driving gears. Shifts from one set to the other were made at speeds of 25, 30 and 40 miles an hour with equal facility, it being easy to tell when the 2.5 to 1 gearing was operating by the easier running of the engine and the general smoother operation of the car as a whole. There was a marked freedom from vibration when traveling at high speeds.

According to the Cadillac engineers, the low drive is especially adapted for city driving, where starting, stopping and slowing down are frequent and where cautious operation is necessary. Where speeds of about 16 miles or more per hour are permissible and desirable the high-direct-drive gear ratio is of special advantage. With it any given speed of the engine produces an increase of about 42 per cent. in the speed of the car, or conversely, to maintain any given car speed the engine speed may be materially decreased as compared with that required to propel the car at this speed with the low gear ratio.

At an engine speed of 700 revolutions per minute with the low direct gear engaged the car will travel about 21 miles an hour, while with the high gearing it will go about 30 miles an hour, the engine speed still remaining constant.

This increase in car speed in its relation to that of the motor is logicaly claimed to effect a saving in gasoline for a given mileage, while friction is reduced due to slower operation of the motor. This, too, should affect the gasoline consumption.

It should be understood that this new axle feature does not affect the transmission gearing in any way, that is, with either set of axle gears operating, the shifting of gears from first to second, to third or to reverse in the gearbox is the same as though the ordinary axle were used. Thus this two-speed axle makes possible six different speeds forward.

Another new Cadillac feature of special interest is the provision made for easy access to the driver's seat from the drive side of the car. One of the arms of the steering wheel is hinged so that the wheel will drop into a vertical position as shown in one of the illustrations on page 170. The arm opposite is made in U-shape to go around the steering column, while there are two latches at the top of the column, which engage notches near the center of the spider and hold the wheel rigidly in normal position when driving. Two little levers, when pressed together release the wheel and allow it to swing downward.

Besides this feature for clearing the entrance, the driver's seat is hinged so as to swing up out of the doorway, while the gear-shifting and emergency-brake levers, which are both within the body and next the door, are so positioned as not to interfere. They are somewhat forward of the wheel when it is in vertical position, although within easy reach of the driver. These features should prove a boon to the fat man.

Delco System Continued

On the new Cadillacs the combination Delco cranking, lighting and ignition system is retained, though several refinements are to be found. Ignition is now taken care of by a dual system, a double arrangement having been used heretofore, employing two sets of spark-plugs. But one set now is required, simplifying the wiring to a great extent. Besides the Delco generator which provides ignition current there is an auxiliary set of dry cells, a single high-tension distributer taking care of either source. Both ignitions are provided with an automatic spark control in addition to the regular spark control on the steering-wheel quadrant.

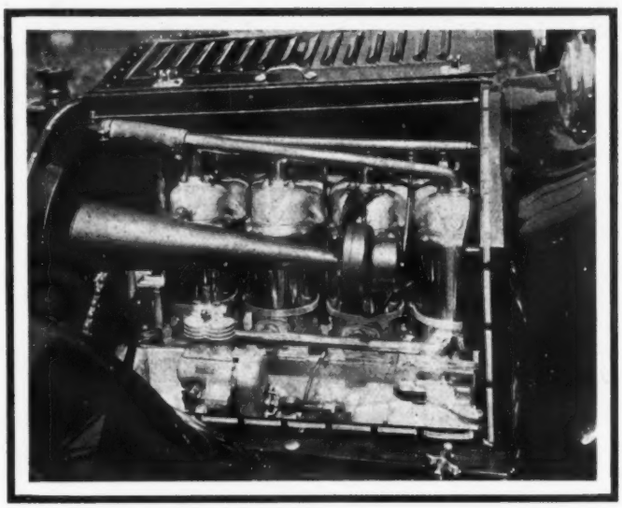
As to the cranking device, its speed of rotating the crankshaft has been increased somewhat. In addition to this improvement an automatic temperature regulator has been placed on the voltage regulator. This, together with the cut-out relay and battery-ignition relay are now contained in a metal box attached to the back of the dash under the hood. Due to the dual ignition, the wiring is reduced about one-half.

Further simplification of the electrical system is found in the elimination of the controlling switch on the generator, its functions now being performed by one of the motor brushes. This brush is so arranged that it is brought into contact with the motor commutator when the clutch pedal is pushed out to bring the cranking device into operation, and is brought away from the commutator when the clutch pedal is allowed to come back after the engine has started. When the brush is brought away from the motor commutator, contacts are closed thereby bringing the generator into operation.

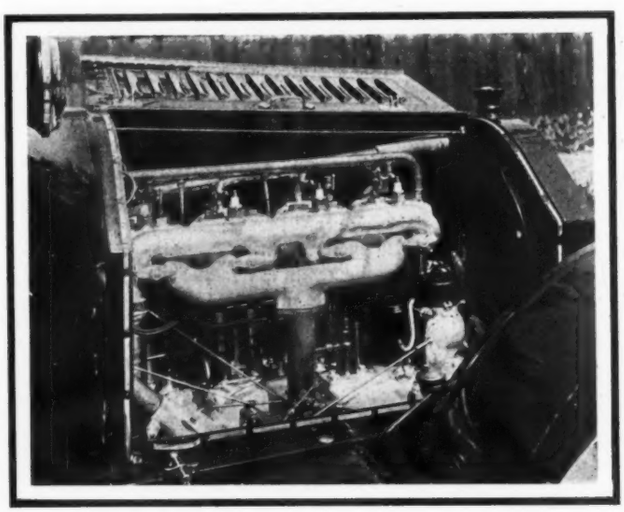
Another point wherein the 1914 edition of the Cadillac factory differs from its predecessors is in the location of the gasoline tank at the rear of the chassis and under the frame. It is back of the axle and between it and the rear cross spring. The gasoline capacity is 20 gallons, the fuel being fed to the carbureter by a pressure system operated by an air pump attached to the crankcase of the motor and driven from the camshaft. The customary fuel gauge showing the amount of gasoline in the tank appears at the right end.

The characteristic Cadillac motor, with its copper water-jacketed, singly cast cylinders is retained. The cylinder heads are removable, so that it is a comparatively easy matter to get at the inside of any cylinder. These heads also carry the valve chambers and pockets integrally with them. A slight change is noticeable in these heads, brought about by the elimination of one of the sets of spark-plugs. Heretofore, these plugs have been placed in the valve covers, the priming cocks being located between them. But on the new models, the single plug is placed between the two covers in about the same position as that formerly held by the priming cock, while this latter is screwed into one of the covers, the other cover remaining blank.

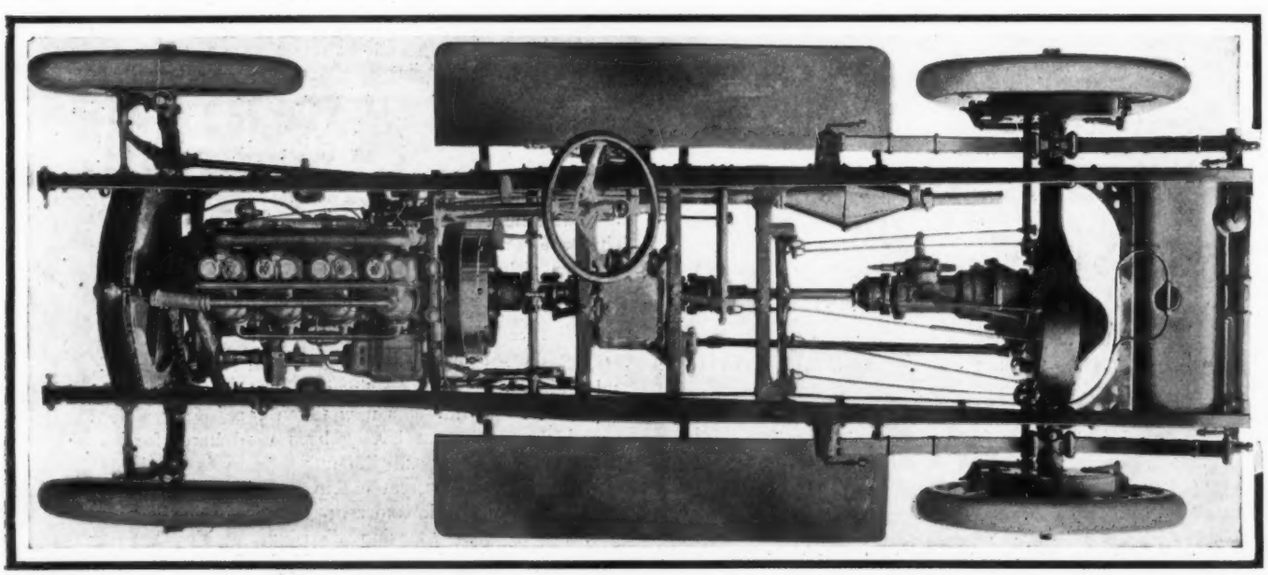
Though there are no other changes in the power plant, it might be well to review the salient features of the Cadillac engine for the benefit of those who are not familiar with it. Of L-head design with valves all on the right side, the manifolds are on this side together with the carbureter and distributer. The left side carries the combined Delco motor and generator back next to the flywheel, to which it gears when cranking the engine. Forward of this electrical unit there is mounted a two-



Left side of Cadillac motor. Note horn mounting behind the radiator and under the hood

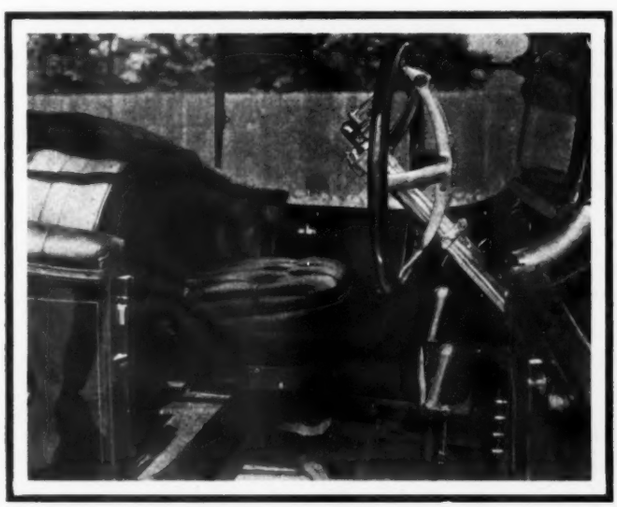


Right side of motor, showing manifold construction for intake and exhaust and carbureter



Plan view of the 1914 Cadillac chassis, showing arrangement of the drive members

Arrangement of the dash and entrance to car from right



Steering wheel folds down, allowing easy entrance

cylinder, air-cooled tire pump, a fixture which appears for the first time on Cadillacs as standard equipment.

The bore is 4.5 inches and the stroke 5.75 inches, giving a stroke-bore ratio of 1.28 and a horsepower rating of 32.4, which is, of course, very low. The actual developed horsepower is from 40 to 50. The crankshaft has five main bearings, one between each pair of cylinders and one at either end. The camshaft is carried on three bearings, and this, as well as the generator shaft are driven by silent chains from the crankshaft instead of gears.

The valve rods and springs are individually inclosed in easily removable cylindrical housings. The valves have a diameter of 2 1-8 inches and their tappets are actuated through rollers which bear on the cams all the time.

Bearings are all of babbitt metal with bronze backing. The principal bearing dimensions follow:

Crankshaft—Rear, diameter, 2 inches; length, 4 inches.
Other four, diameter, 2 inches; length, 2 7-8 inches.
Camshaft—Diameter all bearings, 1 3-16 inches.
Wristpin Bearings—Diameter, 3-4 inch; length, 3 inches (total).

The motor suspension is also distinctive in that there are two I-beam cross bows from which the engine is hung, one at either end. They bolt to the side-frame rails.

The carbureter, of Cadillac design, is somewhat modified on the new cars. A swinging type of air valve has been substituted for the poppet type, while the special auxiliary air inlet has been eliminated. An electrical-heating device is added which vaporizes the fuel in the carbureter before the engine is cranked, thereby greatly facilitating starting, especially in cold weather.

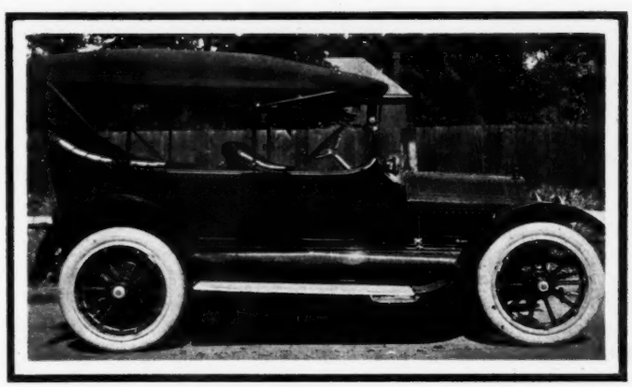
Lubrication of the Cadillac motor is by means of an automatic splash system with even distribution of the lubricant. The lower part of the crankcase is divided into four compartments, one under each connecting rod. Below these and at the right side of the motor there is an oil reservoir from which a pump forces the oil up through a sight feed on the dash and thence pipes it to the connecting-rod troughs. These are so constructed with sloping portions that a constant and even level of lubricant is maintained in each of them.

The axle, which has somewhat of a different appearance, due to the double-driving gears, is a floating type with pressed-steel housing. The principal bearings are of Timken make, and the axle shafts are of a special alloy steel. Though there is nothing new about the front axle construction, an original refinement is to be noted in the concealment of the speedometer-driving gears within the left-front-wheel spindle.

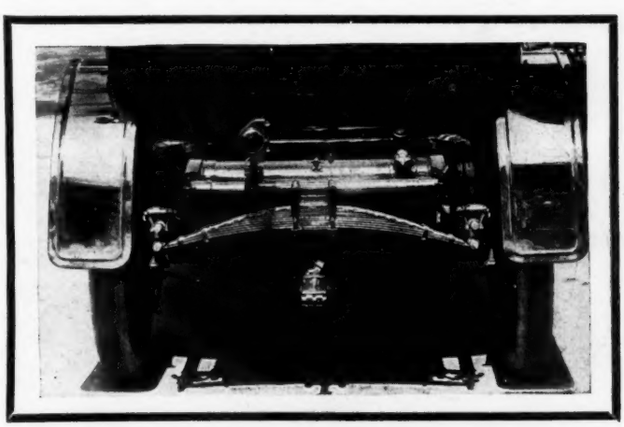
The brakes on the rear wheels remain unchanged, the diameter of their drums being 17 inches while the width is 2 1-2 inches, giving a large braking surface. The rear-side springs have been increased 6 inches in length over those on the 1913 cars. All springs have a width of 2 inches, while their lengths follow:

Front semi-elliptics	36 inches
Rear-side springs	54 inches
Rear-cross spring	39 1-2 inches

Seven body styles are offered this year, they being a five-passenger touring car, seven-passenger touring car, four-passenger phaeton, roadster, landaulet coupe for three, five-passenger inside drive limousine and seven-passenger standard limousine.



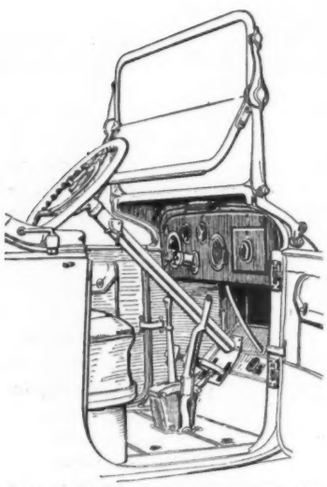
Cadillac car as fitted with stock equipment



Rear view, showing back platform spring mounting

Cole Brings Out Two New 1914 Models

Same Cylinder Dimensions Adopted for Both Four and Six—Electric Starter Continued—Power-Driven Tire Pump Fitted



Cole control, showing ventilating windshield and instrument board

FOR the 1914 season the Cole Motor Car Co. announces its Series Nine, which comprises two new models, a four and a six. Roomy bodies of streamline form are fitted, the four-cylinder model being available with two, four or five-passenger bodies, while the six is provided in three types, seating two, six and seven passengers.

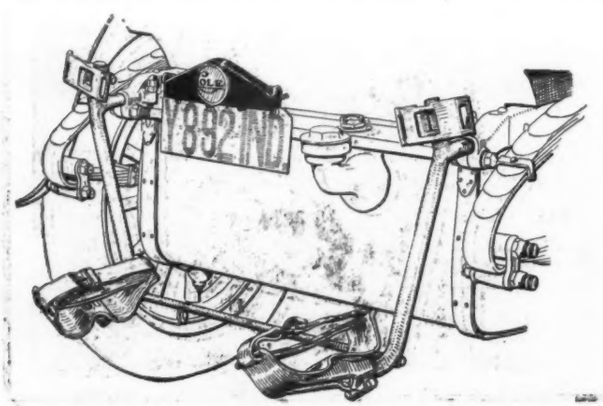
The power plants of both models are identical so far as cylinder size is concerned, the bore and stroke being 4.25 by 5.25 inches in each case. These dimensions are new for the Cole company and in the six represent a considerable increase of power. The horsepower said to be developed by the two new models are respectively 41 and 68. Last year there were three models with as many different sizes of cylinder. The adoption of a single size is another indication of the general trend toward simplification and standardization throughout the automobile industry.

Suspension of the motor is on the three-point principle, the front end being supported on a trunnion with the side points on the flywheel housing.

The crankshaft is forged from 40-point steel and is balanced after grinding. Three bearings are used on the four-cylinder and four on the six. These bearings are all die-castings of white bronze and are provided with shims for easy adjustment.

The connecting-rods are also forged from carbon steel, heat treated after forging. A phosphor-bronze bushing 1-inch diameter is fitted to the top end and a split white-bronze bushing 2.125 inches diameter at the big end. Both bearing surfaces are 2.25 inches long.

The camshaft on the four-cylinder motor is driven as formerly, by helical gears. On the six, however, the silent chain drive has been adopted on the principle that on a six-cylinder camshaft the angular spacing of the cams is such that a practically uniform torque is required, so that a silent chain can be used to advantage.

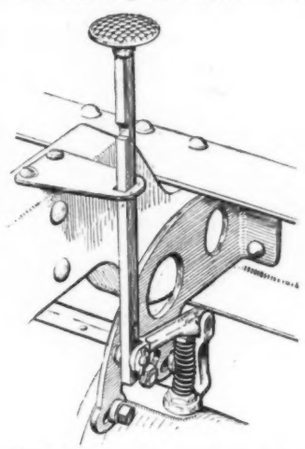


Rear tire carrier, license holder and tank on new Cole

Tungsten-steel valves are used and these are all located on the left side of the motor. The valve lifters are of the roller type and operate in cast-iron guides pressed into the cylinder castings. Quick detachable covers inclose the valve springs. The valve timing on both motors is as follows: Inlet opens 15 deg. late and closes 38 deg. late. Exhaust opens 45 deg. early and closes 10 deg. late.

A Mayo cellular radiator is used as in former practice and a three-bladed aluminum fan of the propeller type behind, driven by a flat leather belt from a pulley on the pump-drive shaft. Adjustment is provided for regulating the tension of the fan belt. The centrifugal water pump is located midway of the motor on the right side.

A Stromberg carbureter is fitted and its position, well up on the left side where it is readily accessible, is rendered possible by the use of pressure fuel feed. For this latter purpose a small air pump is fitted to the left side of the motor, where it is operated from an eccentric on the camshaft. This pump is arranged to supply a greater pressure than is necessary, a small adjustable safety valve being provided by which the tank pressure can be kept at any desired point. The gasoline tank, of 22-gallon capacity, is slung from the rear end of the frame as shown in one of the illustrations, in which the tire carrier is also indicated.



Adjustable muffler cut-out pedal

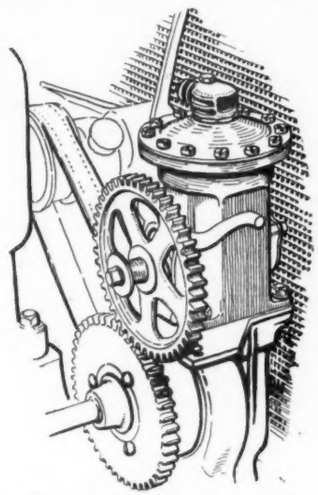
On the six-cylinder motor a water jacket is fitted to the intake manifold to assist in the gasification of low-grade fuel.

Lubrication is by a combination of the constant level splash and pump circulation systems. The oil reservoir on the four has a capacity of 9 quarts and on the six of 12 quarts. The pump, operated from a spiral gear on the cam shaft, draws oil from the reservoir and forces it through a sight feed on the instrument board to the main bearings. An adjustment is provided on the oil pump so that the flow may be regulated if necessary. The connecting-rod caps are provided with spoons which dip into troughs cast in the crankcase. A constant level of oil is maintained in these troughs by an overflow from the main bearings. The surplus falls down into the sump to be circulated again.

A leather-faced cone clutch connects the motor and transmission. The aluminum cone is 14.875 inches in diameter and 2.5 inches wide, with an 11-degree face angle. The clutch hub bearing is of the annular-ball type and a ball-thrust bearing is provided for the throw-out mechanism. Six coil springs hold the clutch in engagement. A leather brake is provided on the rear end of the clutch hub to keep the clutch from spinning

while changing gears. The shafts of the transmission are made of chrome nickel steel and are mounted on annular ball bearings. A roller bearing is used where the sliding gear shaft floats in the clutch shaft extension. The ratio of speeds obtained by the transmission is 1:1 for the high; 2:1 for the intermediate speed; low, 3.65:1, and reverse, 4.76:1. The axle ratio is 4:1 on both models.

A Spicer universal joint is used at each end of the drive shaft. This shaft is 1.25 inch in diameter on the four, and 1.375 inch on the six. The rear axle is of the full floating construction, using Timken taper roller bearings throughout. The drive shafts have six-jawed clutches on their outer ends which mesh with jaws in the wheel hubs. These shafts can be removed without disturbing the wheels, and the whole differential taken out, if necessary, while the car is still supported by its own wheels.



Cole power-driven tire pump

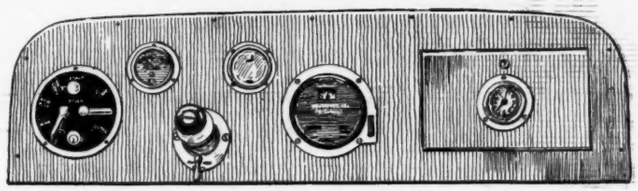
The front axle is an I-beam forging, made of open-hearth steel with two heat treatments. The spindles are chrome nickel steel forgings, 1.5 inch in diameter. The same size axle is used on both four and six-cylinder models. An option of 56-inch or 60-inch tread is offered.

The springs are semi-elliptic in front, 2 inches wide, 37.25 inches long on the four, and 41 inches on the six. The spring eyes are bushed with phosphor bronze. The rear springs are three-quarter elliptic, 50.25 inches long on the four, and 52.25 inches on the six. The internal and external brakes operate on drums which are 15.5 inches in diameter by 2.5 inches wide. Both brakes are faced with Autobestine, an asbestos fabric.

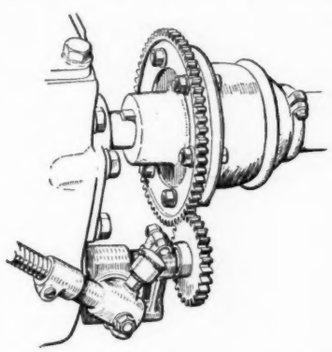
The Gemmer steering gear is mounted on the left side of the car and an 18-inch corrugated wheel is used on both models. The steering gear itself is of the worm and full gear type as has been standard with Cole for the past few years.

The instrument board which is shown in two of the accompanying illustrations, carries the ignition and lighting switches, air pump and gauge, oil sight feed, clock and speedometer and occupies a position within the cowl so that all instruments are in easy reach of the driver. The control levers are located in the center of the floor board. Both clutch and brake pedals are adjustable.

For lighting and starting the Cole company continue with the Delco system. The motor-generator is rigidly mounted on the crankcase and driven through the water pump. For starting action, a gear at the rear of the motor generator is meshed with a gear cut on the rim of the fly-wheel. This action is effected by pressure on a small pedal located on the footboard, which at the same time switches on the current. It is necessary before pressing the pedal to touch a button on the instrument board. This allows a small current to flow through the motor generator which is thus caused to turn slowly, so the gears will readily go into mesh. The ignition end of the outfit is placed on the left side of the motor near the front, and driven by spiral gears from the cam shaft. The ignition timer has a governor for automatically advancing the spark as the speed of the motor increases, but the conventional control is also provided.



Instrument board, showing switch, oil sight feed, air gauge, hand-pump, clock, speedometer, etc.

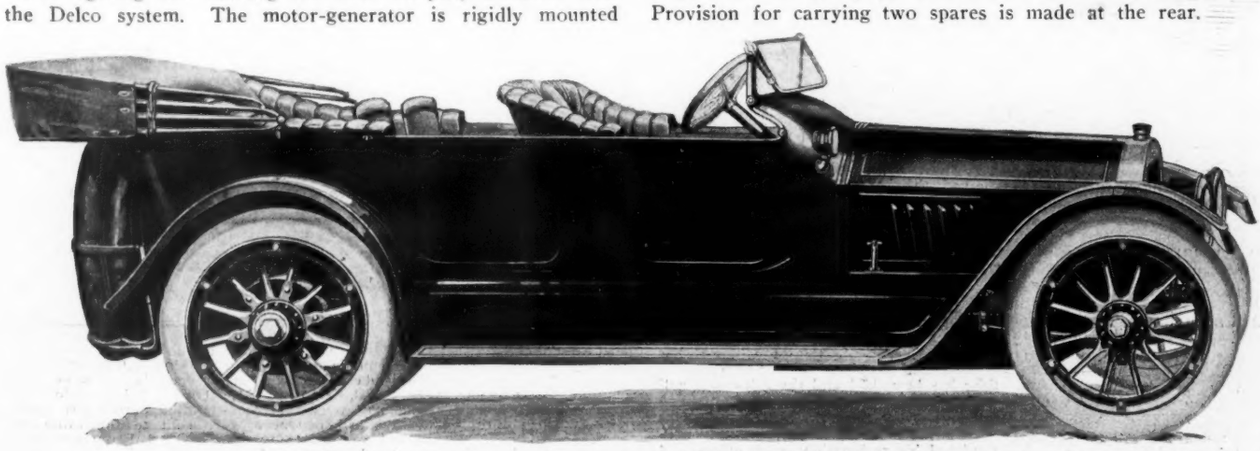


Driveshaft speedometer connection

An interesting unit in the equipment is the power tire-pump, illustrated herewith. This is supported on a bracket at the front of the motor and driven when required from a gear on the pump shaft. This pump is of the rubber diaphragm type, so arranged that it is impossible for any oil to find its way from the pump crankcase into the tires. When required for tire inflation a small lever projecting from the device permits a sliding gear on the rear pump shaft to be meshed with the driving gear.

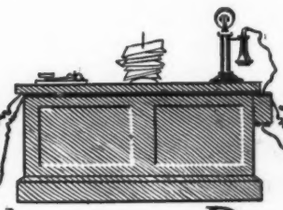
The speedometer gearing is attached to the forward end of the drive shaft, thereby allowing a more direct flexible connection to the instrument than usual.

Complete equipment for each car includes a cloth-lined pantasote top fitted with Collins curtains which fold into the top. Solar lamps, emergency hand lamp, electric horn, and a complete outfit of tools in a drawer under the front seat. Standard tire equipment is 34 by 4.5-inch Firestones for the smaller car and 36 by 4.5 tires of the same make for the six. Provision for carrying two spares is made at the rear.



The new seven-passenger, six-cylinder Cole with steamline body

The Week in the Industry



Engineer — Dealer — Repairman — Garage

OHIO CONTRIBUTES $150,000—Through the efforts of Senator C. J. Howard, of Belmont County, O., the state will furnish $150,000 for the improvement of the National Pike through Belmont County. The money is a part of the 5-mill levy for a system of market roads. Franklin, Licking and Muskingum Counties have arranged for the paving of the National road and only that part extending through Guernsey County is not provided for. The paving will probably be done with brick.

BRADY RESIGNS—A. C. Brady has resigned from the management of the Brady-Murray Motors Corp., New York City.

FORBES P. & S. CHIEF ENGINEER—Kingston Forbes has been made chief engineer of the Palmer & Singer Mfg. Co., Long Island City, N. Y.

NEW HAVEN FACTORY BRANCH—The King Motor Car Co. has opened a direct factory branch for the sale of King cars at 27 Foster street, New Haven, Conn.

KNIGHT TIRE IN ST. LOUIS—The Knight Tire Co., of St. Louis, Mo., has been established to handle the product of the Knight Tire & Rubber Co., Canton O.

MERCEDES IN NEW HOME—Rene J. Marx & Co., Coast distributors for Mercedes cars, have moved into their new home in San Francisco, Cal., on Geary street.

COZZENS WITH PEERLESS—The Peerless Motor Car Co., New York City, announces the appointment of F. H. Cozzens as manager of the motor truck sales department.

FEDERAL TRUCKS USED—Federal trucks are being used by the I. X. L. Transportation Co., carrying passengers up the Cariboo Road from Ashcroft, B. C., to Quesnel.

PACKARD AGENCY MOVES—The Dominion Motor Co., British Columbia agent for the Packard Motor Co., Detroit, Mich., has moved to its new home on Georgia street, Vancouver.

EATON RESIGNS—F. H. Eaton, president of the American Car & Foundry Co., has resigned as a director of the International Motor Co., New York City. Thomas Cochran, Jr., succeeds him.

AUTOMOBILE SHOW AT HASTINGS PARK—On the completion of the new Transportation Buildings at Hastings Park, Vancouver, B. C., it will be opened with an automobile show, August 30.

FIRE TRUCK FOR MERRILL.—The Merrill, Wis., Common Council has voted to purchase a motor-propelled fire truck, and a committee has been delegated to make inspections of various makes.

MINNESOTA COLLEGE'S AUTOMOBILE COURSE—The executive committee of the regents of the University of Minnesota have sanctioned an automobile engineering course. The tuition fee will be $10.

FEWELL GOES TO NEW YORK—W. B. Fewell, until recently manager of the Boston, Mass., branch of the Oldsmobile Co., has accepted a position as manager of the New York City branch of the Oakland.

CLUB AFTER GLASS THROWERS—The Automobile Club of Minneapolis, Minn., has offered $25 reward for the arrest and conviction of persons throwing glass into the highways. The state law is against the practice.

WILLARD WITH ISOTTA-FRASCHINI—E. Augustus Willard has discontinued his business at the former address of 1876 Broadway, New York City, and will join the Isotta-Fraschini Motor Co., at 1920 Broadway, New York City.

BARBER STEVENS-DURYEA MANAGER—A. W. Barber, for some years past with the Stevens-Duryea Motor Co., Chicopee Falls, Mass., has been selected to manage the newly established Coast plant at San Francisco, Cal.

BAKER ELECTRIC ESTABLISHES SALESROOM—The Baker Electric Co., Cleveland, O., has established a salesroom and service station at Milwaukee, Wis., in the building at 137 Oneida street, formerly occupied by Hustis Bros.

WISENBURGH MANAGER N. Y. REMY—C. B. Wisenburgh, traveling representative of the American Distributing Co., Jackson, Mich., has resigned to accept the New York City branch management of the Remy Electric Co., Anderson, Ind.

P. O. BUYS TWENTY WHITES—The Post Office Dept. of New York City has awarded a contract to the White Co., Cleveland, O., for twenty trucks, with a carrying capacity of 1,500 pounds. They will be assigned to various post offices for mail transfer work.

GARFORDS FOR N. Y. POLICE—The R. & L. Co., New York City, eastern distributors for the Garford Co., Elyria, O., recently delivered to the New York police department ten Garford trucks for use as patrol wagons at the various police statjons of the Metropolis.

MAILING JOINS STEWART TRUCK—F. W. Mailing has resigned his position with the Mais Motor Truck Co., Indianapolis, Ind., in the capacitv of general superintendent, and has joined the forces of the Stewart Iron Wks. Co., Cincinnati, O., in like capacity.

HOLLY RESIGNS—A. S. Holly has resigned as manager of the New York factory branch of the Kelly-Springfield Motor Truck Co., to take effect July 31, 1913. Mr. Holly has accepted a position as manager of the truck department of the Packard Motor Car Co., Boston, Mass.

BRIGHTON, MASS., MOTOR PATROL—One of the new motor patrol wagons turned over to Police Commissioner Stephen O'Meara of the Boston, Mass., police department has been sent to the Brighton district, and it is now in service. A similar one is to be sent to the East Boston district.

LOCOMOBILE INCREASES FACILITIES—The Locomobile Co. of Missouri has enlarged its present quarters and has about completed extensive improvements in its salesroom. The tile floor has been laid and the salesroom will have a floor area of 2500 square feet, one of the largest in St. Louis.

BRONNER OUT OF ASSN.—H. M. Bronner, who was formerly manager of the Stoddard Dayton Co., in New York City, and later connected with the Edwards Motor Car Co., has tendered his resignation as an officer and member of the Automobile Dealers' Assn. for the reason that he has severed his connection with the automobile industry.

WHITNEY SOUTHERN LOZIER MANAGER—H. C. Whitney, for several years general southern representative of the American Locomotive Co., Providence, R. I., and more recently connected with the Atlanta, Ga., branch of the Locomobile Co., has accepted the position of Southern district manager for the Lozier Motor Co., Detroit, Mich. His headquarters will be in New Orleans, La.

DRAWBACK ALLOWANCES—A drawback allowance was recently granted by the Treasury Dept. at Washington, D. C., on the exportation of automobiles and automobile bodies manufactured by the Holbrook Co. and the Moore & Munger Co., New York City, with the use of imported chassis, plate glass, leather, carriage cloth, laces, metal fittings, speaking tubes, rubber and cotton cloth, metal chains, etc.

GWINN VICE-PRESIDENT EVERITT—Harry Gwinn, of the Gwinn Sales Co., Columbus, O., central Ohio distributor for the Lozier, has been made vice-president of the Everitt Automobile Co., also of Columbus, central Ohio distributor for the Maxwell. H. K. Dobson has been made president and Ames White, secretary of the company. Both the Lozier and Maxwell will be handled at 172 North Fourth street.

ST. LOUIS EQUIPMENT GROWING—The automobile equipment of the City of St. Louis, Mo., is rapidly growing. The past week saw the addition of no fewer than twenty-nine machines. The present equipment includes thirty-five runabouts, five touring cars, eight ambulances, four fire engines and four service trucks used by the fire department, and the police patrol wagons, and twenty-nine machines will be added to the various departments in the near future.

AUTOMOBILES ALLOWED IN CHARLOTTETOWN—At a meeting of the government of Prince Edward Island, held recently, in compliance to a petition signed by 1,700 citizens, it was decided to permit the running of automobiles in Charlottetown, P. E. I., and royalty on Monday, Wednesday and Thursday of each week. As a first fruit of this decision, four touring cars have been ordered and several others will follow shortly. The order goes into effect at once.

MILLION DOLLAR INCREASE—A million dollar increase in sales for the fiscal year, which ended June 30, with 317 orders for Rambler cars unfilled on the morning of July 14, were striking facts included in a statement made by Second Vice-president G. M. Berry to the branch managers of the Jeffery Co., who met in annual conference at the factory at Kenosha, Wis., recently. The actual increase in sales for the 12-month period, which began June 30, 1912, and ended June 30, 1913, was $1,025,850.

FORTY FERRY SERVICES—A recent list made by the Automobile Club of America shows that there are no less than forty ferry services of which motorists may avail themselves. Although New York City has been closely connected by ferry with Staten Island, New Jersey and Brooklyn for some time, it was only lately that a line attaching the lower part of Westchester county to a central point on Long Island was started. The New Rochelle-Glen Cove line has shown by the heavy patronage of the last month that it is something motorists have wanted.

GAS GENERATOR COMPANY ORGANIZED—The Uhrlandt Gas Generator Mfg. Co., Columbus, O., recently chartered with an authorized capital of $50,000, has been organized to manufacture gas generators for the purpose of using kerosene for the running of automobiles. Patents have been applied for on two of the processes used. It is claimed that a gallon of kerosene will run a car three times the distance of a gallon of gasoline. It is claimed the invention will revolutionize the operation of motor cars.

WEED WITH LOZIER—H. S. Houpt has appointed C. D. Weed, recently of the Alco company, city salesman of the Lozier Motor Co., New York City. Mr. Weed has been in the automobile business since the one-cylinder days, but has been in the selling end only 3 years. Last year he sold $190,000 worth of Alcos, which established a record in that organization for individual salesmanship. The other new Houpt acquisitions of the week include C. G. Drum, formerly of Wyckoff, Church & Partridge, and G. N. Clark, formerly of the R. & L. Co.

NEW VENTILATING DEVICE—Frank Wiemeyer, of the Wiemeyer Motor Co., 3132 Park avenue, St. Louis, Mo., has invented a device which will convert the windshield used on Ford cars into a ventilating windshield. The device consists of two brackets which set back from the dash about 4 inches, and which hold the windshield in the same manner as fitted on the dash. The brackets can be attached to any car in 5 minutes, and when once put on a car, the position of the windshield can be changed in 1 minute, often necessary in wet weather. The brackets will be marketed by the Wiemeyer company.

PARKERSBURG FIRE CHIEF ORDERS FORD—Safety Director Perkins of the Parkersburg, W. Va., fire department has ordered a Ford touring car for the officials of the department. The car has been bought through the agency of the Logal Carriage & Automobile Co., of the same city. The department has also almost closed negotiations for the purchase of other motor equipment, including a chief's car with an attachment for a hook-and-ladder wagon, which vehicle is a Cadillac. The town has also purchased a Kisselkar, for the service of the policy department, which is equipped with a patrol and ambulance body.

PACKARD ADDS TWO TRUCKS—The Packard Motor Car Co., Detroit, Mich., has added 4 and 6-ton trucks to its line of motor vehicles. The company also announces a hydraulic hoist and dump body to meet the growing demand for such motor truck equipment. During the last 12 months, the Packard truck organization broke all of its earlier records for sales and eclipsed the previous year by the sum of $1,980,000. Sales made last month showed a gain of $267,000 over the corresponding period last year. The record month was March, when trucks were sold to the value of $925,100. The former record was made in December, 1912, when over $800,000 worth of Packard trucks were sold.

CHANGE IN GARFORD AT BOSTON—P. C. Chrysler, of New York, who has been manager of the New England branch of the Garford for the past year since the R. & L. Co., of New York, took it over, has resigned and gone back to the New York branch. His place in Boston has been taken by R. F. Ketchum, who had formerly been manager of the General Motors branch and later with the International Motor Co.

WALLINGFORD HAS FIRE WAGON—Better protection is now afforded the residents of Wallingford, Conn., from fire by reason of a new motor chemical installed in that town, for the wagon not only takes the hose reel of the Wallace hose company, at whose house it is located, but that of the Tibbets hose company as well, so that when the members of those two companies hear an alarm they head for the fire instead of going to the hose houses, and on reaching the fire find their apparatus ready for them. It saves them a lot of time and it is working out well.

MILWAUKEE TO HAVE TRUCK PARADE—The Milwaukee automobile club is making plans for a huge commercial vehicle demonstration and parade on Labor Day, September 1, which will be the first event of this kind ever arranged in Milwaukee. Oscar Stegeman, president of the Stegeman Motor Car Co., has been appointed chairman of the special committee of truck builders and large truck owners to have charge of the demonstration. The main idea is to show the people of Milwaukee in concrete form the vast number of motor-propelled freight carriers used in the city and the wide application to businesses of all kinds. A small entry fee will be charged to pay the expenses of banners and signs.

BUILDING HIGHWAYS IN TEXAS—The commercial organizations of Alpine, El Paso and other Texas towns on the route of the proposed automobile highway that is to be constructed between El Paso and San Antonio, a distance of 600 miles, are giving the project every possible aid and encouragement. The commissioners' courts of the different counties are showing an active interest in the proposed road, and the necessary money to construct the different links will soon be provided, it is announced. The route selected is through the most scenic part of the Southwest. It will mount the highest point between New Orleans and Los Angeles at Paisano, a few miles west of Alpine, an altitude of more than 5000 feet being reached there. It will also follow the canyons of the Rio Grande and Devil's River for some distance.

Recent Incorporations in the Automobile Field

AUTOMOBILES AND PARTS

BEAVERTOWN, PA.—Kearns Motor Truck Co.; capital, $100,000; to manufacture motor trucks.

BOSTON, MASS.—Marathon Automobile Co.; capital, $25,000; to deal in automobiles. Incorporators: W. Sanford, B. Killars, A. L. Schoolcraft.

BROOKLYN, N. Y.—Grand Avenue Co.; capital, $500; motors, engines, etc. Incorporators: G. F. Mason, F. G. H. Strohsall, H. W. Bender.

CARROLLTON, O.—Wood Auto & Machine Co.; capital, $10,000; to deal in automobiles. Incorporators: E. A. Wood, J. P. Monnyhan, E. C. Smith, P. B. Gaines.

CINCINNATI, O.—Nyberg Auto Sales Co.; capital, $25,000; to deal in automobiles and supplies. Incorporators: E. Hine, Alexis Darusment, R. R. Ross, Alexis Darusment, Jr., C. H. Smith.

CLEVELAND, O.—Ohio Buick Co.; capital, $200,000; to manufacture and deal in automobile parts and supplies. Incorporators: R. H. Lee, W. J. Patterson, G. R. Collar, G. M. Gallagher, E. M. Holmgren.

FAIRFIELD, ME.—Eastman Transportation Co.; capital, $10,000; to operate automobiles, motor trucks and vehicles of all kinds. Incorporators: A. M. Eastman, J. M. Eastman.

GIBSONBURG, O.—National Motor Truck & Mfg. Co.; capital, $250,000; to manufacture and deal in automobiles and motor vehicles. Incorporators: E. C. Rassell, C. H. Hutchison, J. H. O'Leary, A. T. Crossett, F. E. Lamb, J. E. Weisel, N. W. Rassell.

HOUSTON, TEX.—Green Taxicab & Automobile Co.; capital, $15,000; general automobile taxicab business. Incorporators: F. W. Crow, E. H. Wiess, W. W. Kyle.

JACKSONVILLE, FLA.—Central Automobile Supply Co.; capital, $5,000; to deal in automobiles. Incorporators: E. R. Whitner, S. A. Thurman, C. M. Yent.

JOLIET, ILL.—Joliet Motor Co.; capital, $10,000; to deal in automobiles. Incorporators: W. S. Campbell, J. H. Garnsey, M. F. Lennon.

NEW ALBANY, IND.—Fall Cities Motor Co.; capital, $50,000; to manufacture automobiles. Incorporators: Ferdinand Kahler, Sr., Orland E. South, G. R. Elder.

NEW YORK CITY—Anthony Auto Repair Co.; capital, $10,000; to deal in automobiles. Incorporators: Julia Yandrasitch, F. M. Struckhausen, Henry Struckhausen.

NEW YORK CITY—Hayes-Diefenderfer Co.; capital, $10,000; to deal in automobiles. Incorporators: L. W. Bennett, E. Hayes, A. J. Diefenderfer.

NEW YORK CITY—Bell Locomotive Wks.; capital, $20,000; to manufacture automobiles. Incorporators: H. W. Bell, J. H. Bell, Francis William G. Bellows.

NEW YORK CITY—Standard Purchasing Co.; capital, $10,000; to deal in automobiles. Incorporators: H. F. Dexter, M. H. Brooks, H. L. Cook.

NEW YORK CITY—Michigan Motor Car Co.; capital, $31,500; to deal in automobiles. Incorporators: Kenton Marman, J. A. Murphy, C. A. Wolfe.

NEW YORK CITY—Le Compte Cycle Car Corp.; capital, $60,000; to deal in automobiles. Incorporators: H. R. Buckingham, L. S. Higgins, Godfrey Goldmark.

PHILADELPHIA, PA.—Bigelow-Willey Motor Co.; capital, $50,000; to manufacture, buy, sell and deal in and with electric machines of all kinds. Incorporators: Jay Bigelow, G. A. Willey, E. C. Benson.

PHILADELPHIA, PA.—Warner Spring Mfg. Co.; capital, $50,000; to manufacture and deal in automobiles and all kinds of motor vehicles.

PHILADELPHIA, PA.—Mecca Automobile Security Co.; capital, $50,000; to deal in automobiles. Incorporators: C. M. Miller, W. F. Voshell, L. T. Taylor.

PORTLAND, ME.—Trackless Transportation Co.; capital, $10,000,000; to manufacture vehicles. Incorporators: E. E. Noble, E. V. Mann.

PULASKI, VA.—City Auto Corp.; capital, $45,000; to deal in automobiles. Incorporators: S. M. Lyon, W. H. Wysor, R. L. Gardner.

RACINE, WIS.—Racine Drop Forge Co.; capital, $20,000; to manufacture motor car forgings and parts. Incorporators: Adam and Peter Blackwood.

WILMINGTON, DEL.—Brookes Motor Car Co.; capital, $5,000,000; to manufacture automobiles. Incorporators: C. B. Bishop, C. J. Jacobs and H. W. Davis.

GARAGES AND ACCESSORIES

BIRMINGHAM, ALA.—Ensley Motor Co.; capital, $10,000; general garage business. Incorporators: J. C. Barrett, O. W. Craig, T. J. Barrett.

BROOKLYN, N. Y.—E. A. Laboratories, Inc.; capital, $100,000; to manufacture automobile accessories. Incorporators: Emanuel Aufiero, Michael Aufiero, Daisy Aufiero.

BROOKLYN, N. Y.—Trautman Corp.; capital, $1,000; automobile tire business. Incorporators: E. M. Trautman, F. A. Webb, Charles Colsten.

BROOKLYN, N. Y.—Vacuum Tire Corp.; capital, $50,000; to deal and manufacture automobile tires. Incorporators: W. J. Woodcock, C. G. Ross, F. L. B. Gartner.

BUFFALO, N. Y.—Buffalo Auto Accessory Mfg. Co., Inc.; capital, $20,000; to manufacture automobile accessories. Incorporators: J. B. McCready, J. T. Miller, E. S. McCready.

CHICAGO, ILL.—Universal Appliance Co.; capital, $30,000; to manufacture automobile accessories. Incorporators: D. M. Cunningham, F. E. M. Gieskbrecht, W. Reetz.

CINCINNATI, O.—W. L. Auto Top Lifting Co.; capital, $10,000; to manufacture and sell automobile top lifting and raising devices and deal in automobiles and accessories. Incorporators: Walter Wirth, Oscar Lane, H. W. Fraser, G. H. Reswick, J. B. Clark.

CLEVELAND, O.—Cady Auto Jack Co.; capital, $10,000; to deal in automobile accessories. Incorporators: O. O. Vrooman and others.

MIDDLETOWN, N. Y.—Talking Horn Co.; capital, $10,000; to manufacture automobile and bicycle horns. Incorporators: N. C. Oddo, T. H. Bingham, F. W. Morgans.

NEW YORK CITY—Vanden Plas of America; capital, $10,000; to manufacture and deal in automobile bodies. Incorporators: Lignell Perera, A. Vanden Plas, W. S. Newhouse.

NEW YORK CITY—Commercial Oil & Gas Co.; capital, $1,000,000; to deal in oils. Incorporators: J. L. Douglass, J. W. Ebbs, J. F. Mosely.

NEW YORK CITY—Ardsley Garage Co.; capital, $60,000; general garage business. Incorporators: Sigmund Meyer, M. A. Cramer, Joseph Fischer.

PHILADELPHIA, PA.—National Rubber Co.; capital, $2,500,000; to manufacture automobile tires.

PHILADELPHIA, PA.—Hardman Tire & Rubber Co.; capital, $10,000; to manufacture automobile tires. Incorporator: S. C. Seymour.

WHEELING, W. VA.—Schick Wheel & Tire Co.; capital, $150,000; to manufacture and sell automobile tires and wheels. Incorporators: Adolph Schick, J. E. Morgan, D. H. Taylor, L. F. Gundling, R. Walter, Marshall and O. A. Statler.

WILMINGTON, DEL.—International Metal Wheel & Supply Co.; capital, $100,000; to manufacture and sell wheels for automobiles.

WAUKESHA, WIS.—Bartles-Shepard Oil Co.; capital, $40,000; to do a wholesale and jobbing business in lubricants and motor fuels. Incorporators: A. G. Maguire, A. U. Stotten, J. H. Marshutz.

CHANGES OF NAME AND CAPITAL

CANAL DOVER, O.—Wooster Garage; change of name to the Dover Automobile Co.

MILWAUKEE, WIS.—Federal Pressed Steel Co.; capital increase from $50,000 to $150,000.

MILWAUKEE, WIS.—Wold Bros.; change of name to the Wold Bros. Co.

RICHWOOD, O.—Scharf Gearless Motor Car Co.; capital increased from $5,000 to $50,000.

ST. LOUIS, MO.—Batnell Automobile Co.; change of name to the Cole Motor Co. of Missouri.

New Agencies Established During the Week

PASSENGER VEHICLES

Place	Car	Agent
Albany, N. Y.	R-C-H	Kemps Garage
Bradford, Pa.	R-C-H	Smith Agency
Bridgeport, Conn.	R-C-H	H. M. Ford
Brockton, Mass.	Paige-Detroit	F. W. & W. A. Swift
Columbus, O.	American	Gaither Auto Co.
Columbus, O.	Paterson	Batdorf
Columbus, O.	Hudson	Standard Motor Car Co.
Edwardsburg, Mich.	R-C-H	Pearson & Pearson
Gloucester, Mass.	Paige-Detroit	C. P. Wonson
Grand Rapids, Mich.	R-C-H	Robert Willey Auto Co.
Haverhill, Mass.	R-C-H	S. E. Case
Hopedale, Mass.	R-C-H	G. E. Clifford
Huntington, N. Y.	R-C-H	W. H. Flessels
Houston, Tex.	R-C-H	Northrup & Clark
Jackson, Mich.	R-C-H	Weber Bros.
Lake City, Mich.	R-C-H	Orville Dennis
Lynn, Mass.	Paige-Detroit	C. E. Whitten
Milwaukee, Wis.	Chalmers	Hoppe-Hatter Motor Co.
Milwaukee, Wis.	R-C-H	Smith-Hoppe Auto Co.
Milwaukee, Wis.	Stevens-Duryea	Hustis Bros.
Minneapolis, Minn.	Hudson	Twin City Motor Car Co.
Minneapolis, Minn.	R-C-H	Haynes Motor Car Co.
New Haven, Conn.	King	King Motor Car Co.
Newton Highland, Mass.	R-C-H	Woodworth & Adams
New York City	Ford	I. Davega, Jr., Inc.
Omaha, Neb.	R-C-H	Lininger Implement Co.
Pittsfield, Mass.	R-C-H	G. P. Rose
Rochester, N. Y.	R-C-H	A. Elliott
St. Francisville, Ill.	R-C-H	W. J. Daily
St. Louis, Mo.	Inter-State	Donovan Auto Co.
Utica, N. Y.	R-C-H	I. R. Gardinier
Vancouver, B. C.	Inter-State	Davie Vulcanizing Co.
Walkerton, Ind.	R-C-H	J. C. Domer
Williamston, Mich.	R-C-H	Gaylord & Maher

COMMERCIAL VEHICLES

Minneapolis, Minn.	Republic	Chase Motor Truck Sales Co.

ELECTRIC VEHICLES

Milwaukee, Wis.	Baker	Baker Elec. Agency.
Milwaukee, Wis.	Borland	Hustis Bros.

Accessories for the Automobilist

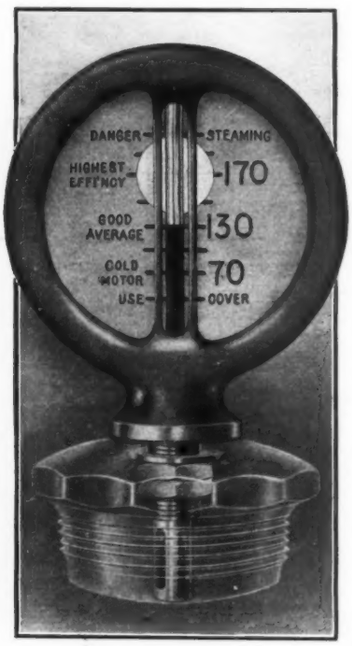


Fig. 1—Motometer

GALLAGHER 1913 Carbureter—The Gallagher Carbureter Co., Inc., New York City, has just brought out its 1913-1914 carbureter, illustrated in Figs. 2, 3 and 4. This carbureter is of the mechanical type, as the former models, that is to say, the movement of each part is positively controlled by the driver and not by the engine suction; but in this model there have been incorporated several improvements of detail, especially the float adjustment, constructed to compensate for variation in atmospheric conditions, and also the auxiliary air device which, according to the driver's wish, is made to supply hot air, cold air or a suitable proportioned mixture of both; there is also the option of entirely shutting off the auxiliary air supply.

The fundamental principle of the carbureter, which has been continued for this year, is illustrated in Figs. 2 and 4. The throttle, instead of being formed as the conventional butterfly, is a vertical, rotatable sleeve valve stationed in an extension of the carbureter housing and operated by a link connection from the throttle rod T which is wired to a dash control. The gasoline enters the concentric float chamber by way of an inlet G, which is controlled by a needle linked through S1 ond F1 to the copper float F. The vaporization of the fuel is obtained by two nozzles supplying a high-speed jet H and a low-speed jet L, which are both bored through a piece fitted into the venturi tube and both controlled by needle adjustments. The nozzles are in the form of two parallel passages bored through the piece mentioned. The low-speed adjustment controls the thinner passage in which capillary action obtains and which serves for starting the motor when the throttle is almost closed. The screw B serves for adjusting this needle, as does A for the high-speed jet. The needle H of the latter is pinned to a sleeve which fits into a screw-threaded guide, so that if the sleeve is turned the needle valve is raised or lowered, thereby opening or closing the nozzle it controls to a varying degree. The link connection between A and T is more clearly shown in the photographic view, Fig. 3.

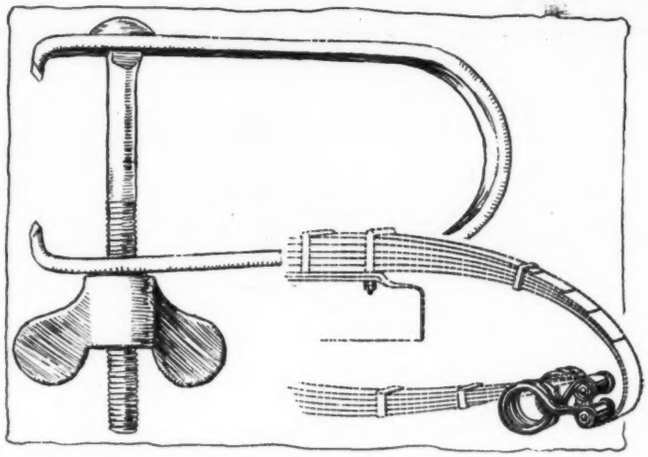


Fig. 5—Security spring spreader. Fig. 6—Acme torsion spring

To permit of adjusting the level of the float to the various temperatures and moisture contents of the air, the cap which covers the head of the screw S, Fig. 4, is removable, making access to S possible. The screw is fitted into a locknut S1 and carries the needle N at its lower end. By turning S while holding N to its seat, the locknut S1 may be raised or lowered, resulting in a corresponding movement of the float F.

The auxiliary air adjustment consists in a metal angle fitting into a cylindrical valve cage which forms an expansion to the lateral extension of the lower part of the housing. If the point E of the valve is brought to the point A of the housing extension, nothing but hot air—which is taken through a pipe mouth attached to the exterior of the exhaust pipe—enters, while bringing E over B suppplies cold air only. Between these two positions, mixtures of hot and cold air are supplied, while, if the valve is in the position here shown, the auxiliary supply is shut off entirely.

New Motometer Model—The Motometer Co., Inc., New York City, has announced a new model of its Boyce Motometer, which is known as the Junior type. The difference between this and the original type is that the dial, Fig. 1, not only gives the temperature of the radiator water, but also concise explanations of the different temperatures. As the illustration shows, the device consists of a watch-like thermometer, filled with a red liquid and mounted on a nickel or brass-plated frame. The glass tube is inclosed in a metal one which screws through a hole tapped in the filler cap. This device is made for the Motometer concern by the Taylor Instrument Co., Rochester, N. Y.

Security Spring Spreader—The Security Reliner Co., Montgomery, N. Y., is now manufacturing the Security spring

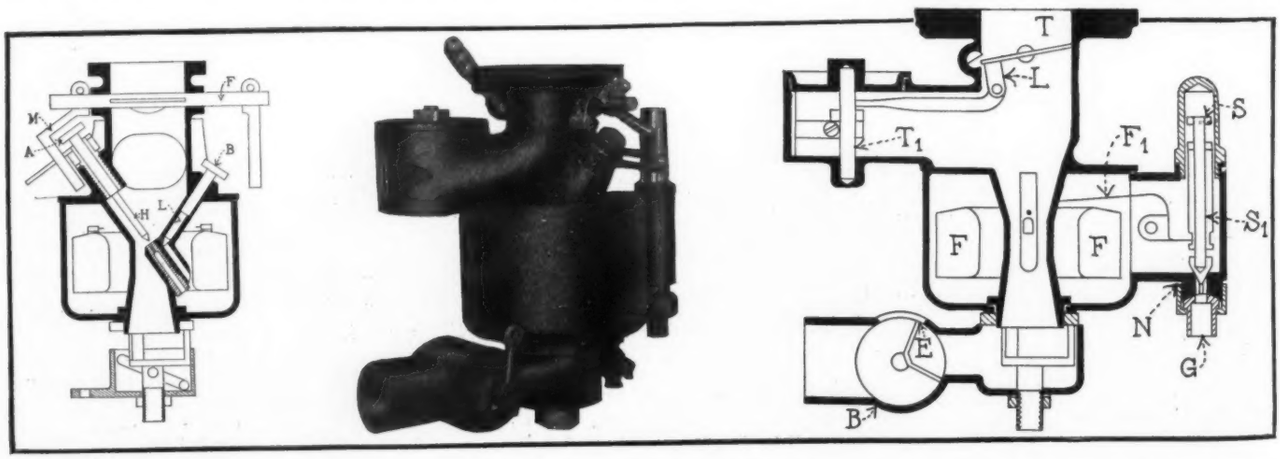


Fig. 2—Section showing Gallagher carbureter jets. Fig. 3—Outside view of the carbureter. Fig. 4—Section showing float mechanism

What's in A Name?

WHEN we stamp the name MULTIBESTOS in bold, bright letters on our brake lining we do more than make a selfish bid for your business—we do more than offer you a means of identifying MULTIBESTOS from the other linings not so good.

We say to you: Here is a brake lining we are proud of; a brake lining we are glad to have you compare with any other under any conditions of service; a brake lining which we, as manufacturers, stand back of with a most liberal guarantee.

Do you think we could afford to do this if we didn't feel sure that MULTIBESTOS is the best brake lining made?

Standard Woven Fabric Company

Worcester, Mass.

Sales Branches:

NEW YORK, 276 Canal Street
CHICAGO, 1430 Michigan Blvd.
PHILADELPHIA, 1427 Vine St.
BOSTON, 903 Boylston St.
SAN FRANCISCO, Fred Ward & Son, Inc.

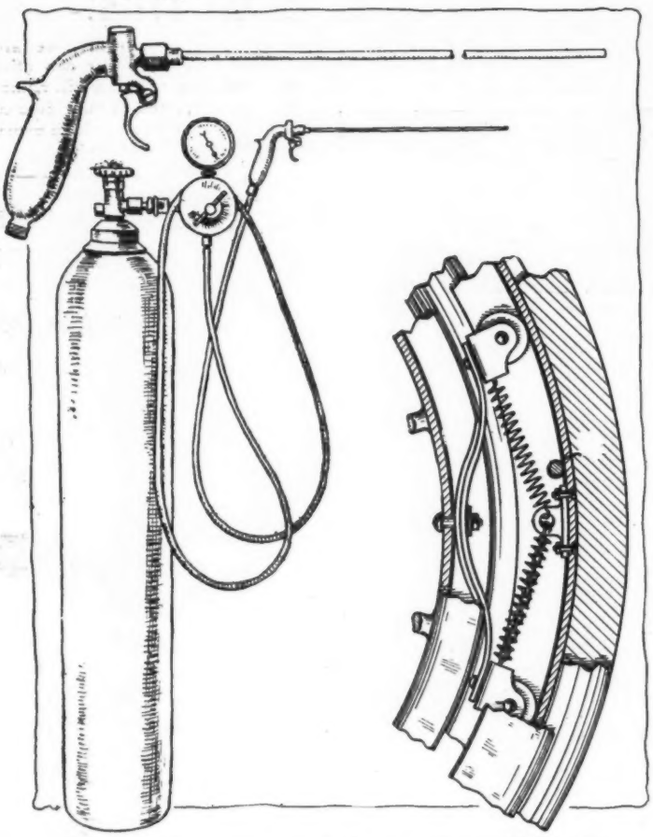


Fig. 7—Dyer oxygen-gas outfit for decarbonizing work
Fig. 8—Sectional view of part of Gay-Streibich wheel

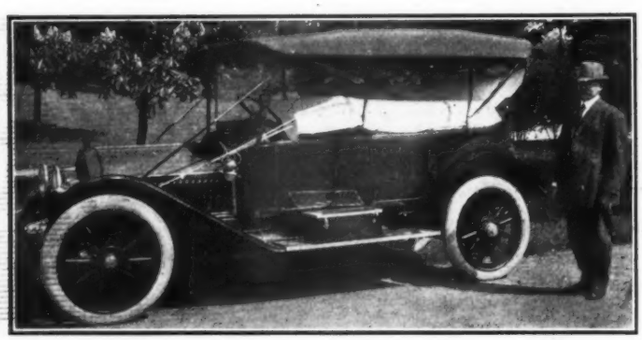


Fig. 9—Bradley Autobed, which is put in operation in the car

spreader, Fig. 5. This tool is extremely simple and efficacious, being composed of three pieces only, namely, a bent piece of spring steel punched with two holes, a screw-threaded bolt passing through these, and a wingnut working on the bolt. By the use of this wingnut the bent steel piece may be compressed. In operation, the spreader is fitted over the spring and the two points are placed between two leaves, after which the wingnut is turned to compress the spreader steel, which separates the leaves and permits the injection of lubricant between them.

Acme Torsion Spring for Fords—The Acme Torsion Spring Co., 998 Boylston street, Boston, Mass., has brought out a torsion spring specially designed for Ford cars. This spring, the construction of which is perfectly plain from Fig. 6, simply replaces the ordinary shackle and due to its elastic nature absorbs a great deal of the vibration which otherwise would be transmitted from the tires to the chassis and vice versa. The torsion springs are guaranteed not to break.

Dyer Oxy-Carbon Removing Outfit—The Dyer Apparatus Co., 39 Piedmont street, Boston, Mass., is the manufacturer of the carbon-removing outfit, Fig. 7. This device consists of a reducing valve which carries a pressure gauge and a gas gun, so to speak, including a trigger device for permitting of intermittent and varying efflux of gas. It is attached to an oxygen gas tank, first the reducing mechanism and then the trigger device. In operation, if the decarbonizing outfit is to be used, the carbureter is drained, the valve caps are removed and the piston first to be cleaned is run to the top of the cylinder. The device is made ready by first opening the reducing valve widely, then opening the oxygen tank valve and holding the trigger open. While doing the latter, after the gas has begun to rush out of the tank, the reducing valve is gradually closed until the gauge shows 25 pounds pressure, when, with open trigger, the device is ready for use. A lighted match is placed in the valve cap hole and the stream of oxygen emerging from the spout end of the trigger device is directed against it, whereby carbon deposits are burned. When finished with the outfit, the T handle of the reducing valve is unscrewed and then the tank valve closed.

Gay-Streibich Spring Wheel—The resilient wheel made by George R. Gay, 116 Louisiana street, Little Rock, Ark., is seen in Fig. 8. It consists of two concentric rims kept properly spaced by means of leaf springs, the recoil of these being taken up by helical springs. The center point of each leaf spring is attached to the inner rim, while the ends are fitted with rollers which are slidable on the outer rim. The space between the two rims is covered on the sides by a material held in place by a spring, thereby insuring the exclusion of dust and dirt.

Bradley Autobed for Tourists—Dr. R. L. Bradley has recently applied for a patent on his invention shown in Fig. 9, the Autobed. This bed is made of heavy canvas, with a hem at each end, through which a stretcher bar runs. To the ends of these bars fasten the front and rear supports, which are secured to the respective springs by means of ropes. When not in use, the bed is rolled around the stretcher bars and made into a handy package.

McCormick Misfire Detector—The McCormick Mfg. Company, Dayton, Ohio, has devised a simple tool for easily detecting misfires in engines and avoiding the possibility of a shock, as is often incurred when metal tools are used. The device consists simply of a long piece of steel held in an insulating handle, and destined to take the place of the screwdriver which is often used as a makeshift device for detecting wrong firing. The use of this device consists in placing the point of the steel rod of the detector on any metal part of the engine and to put the wide end of the steel, where it is held in the handle, against the spark-plug terminal, thereby short circuiting the current. If the plug has been firing properly, the engine will lose power and consequently speed, while, if no such decrease is noticed, this is proof of the fact that the plug thus tested misfires and the trouble has to be remedied in some way or other.

Rex Anti-Slip Brake Wafers—The Armiger Chemical Company, Chicago, Ill., manufactures a very useful and cheap accessory, which, however, should be included in the touring outfit of each automobilist, as it is a precaution against loss of property and life. This accessory is the Rex anti-clip brake wafer, composed of a resinous chemical, which is placed in the bottom of the brake drum on the braking face of the lining, and which, if the brakes are applied, is smeared all over the surface by the action of the shoe. By the action of the resinous material, the effect of the oil which often gets into the brake drums is annihilated and the brakes are insured to hold, which otherwise they might not do in a critical moment.

Carbonox Deposit Remover—One of the latest carbon deposit removers on the market is the product of the Northwestern Chemical Company, Marietta, O., which is called Carbonox and sells in cans of various sizes, fitted with a combination cap and spout. Carbonox is a compound which loosens the carbon deposited on the cylinder walls by dissolving the only material which binds it thereto, after which it keeps the carbon in suspension and makes its combustion possible. It is a mixture of various constituents, some of which are very volatile. To remove the deposits from the cylinders by means of Carbonox about .5 pint is used for four cylinders. The liquid is poured into the combustion chambers through the spark-plug holes, and if this is done while the engine is hot the spark-plug should be replaced immediately to prevent evaporation of the remover; whereas, if the engine is cold it is good practice to soak the plugs in a small pan filled with Carbonox to remove oil and carbon from the sparking points. After this is done the plugs are put back in their places, and the engine is turned over a few times, with the ignition system shut off. After 20 minutes the engine is started and run until the exhaust is clear, which indicates that all the carbon suspended in the remover fluid has been burned. As soon as this is the case, a little lubricating oil should be squirted into every cylinder through the priming cup. The whole operation is so simple that any tyro can carry it out and its effect, which depends on a simple chemical process, is unfailing and necessary.